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LABOUR CLAUSES IN MUNICIPAL CONTRACTS.

IT is to be feared that the ascendency of labour interests in Parliamentary and municipal life will, without the exercise of some wholesome check, become a serious menace to the industries of the country. To no branch does it constitute a graver danger than to the electrical, merely by reason of the enormous expansion that lies before it. To every class belongs the inalienable right of direct representation in our governing bodies; but a sober investigation into recent legislation and the administration of local affairs suggests that it has become the fashion of the hour to legislate and to administrate solely in the interests of the working classes. No reasonable student of human affairs ought to regret the amelioration in the lot of the workman, but it must not be forgotten that he personally contributes little to the improvement in his environment. We have been told that "whoever commands the sea commands the trade," and in the endeavour to achieve the truth of that aphorism this country has built up a colossal navy; but how much does the working man contribute towards maintaining the vast armaments that ensure his daily bread? We are not actuated by any personal feeling against the representatives of labour, but it ought to be realised that the workman gets a good deal for nothing.

The tactics pursued by many municipalities, ostensibly in the interests of the working classes, are not only reprehensible in themselves, but are likely to do infinite harm to the trading interests of the country. We are not at the moment concerned with the question of the municipal control of lighting, of tramways and other kindred undertakings, but we do emphatically protest against the indiscriminate use that is being made of the labour clause which insists upon the payment of trades union wages. Electrical contractors, among others, have been in many instances compelled to swallow these objectionable regulations, but it is obvious that a combined defence must sooner or later be undertaken by the manufacturer.

This defence may take two forms, it will lead either to an increase of prices or a determination to reject contracts which contain labour clauses. Either course must necessarily tend to the confusion of the municipalities; if the latter be adopted it will compel local authorities to obtain their plant from Germany or America, where labour clauses do not exist, or they must pay enhanced prices for English plant. In other words, they must pay heavily for home made machinery, or starve the working man.

Common honesty ought to dictate that a municipality represents the interests of a community which is not entirely made up of the labouring classes. The members of Corporations have not yet been elected at the polls on the capital *v.* labour question, and if they insist upon the interests of one class at the expense of another, then public life is becoming rotten,

and there is need of men who have sounder conception of the principles of local government.

The labour clauses themselves are bad enough, but besides enforcing them, some municipalities are anxious to go a little further. Mr. Ferranti, at the dinner of the Northern Electrical Engineers last week, stated that he had a contract offered to him by the committee of a Town Council, who made it a condition of acceptance that they should have the right to call up any of his workmen to discuss the method in which he conducted his business. The proposal is as impertinent as it is dangerous. Apply it for a moment to a municipality. Supposing the Local Government Board insisted upon calling up the permanent officials for the purpose of ascertaining how the various committees discussed and carried out their business, we venture to think such a suggestion would be held to be an invasion of the free institutions of municipal government.

We have arrived at a crisis in the affairs of the electrical industry, and to ensure its success in the future, strong measures are necessary.

RAILWAY SIGNALLING POPULARLY EXPLAINED.

The comments of the average "man in the train" on the causes which may have led to disaster on any of our railways, or the unpunctuality of the trains by which he is accustomed to travel are, in the majority of cases, more amusing than instructive, on account of the evident want of knowledge of the detail working of railway traffic. This lack of knowledge, however, does not prevent his indulging in invective, or sarcasm, at the expense of the unfortunate officials concerned. Probably he is seen at his best in a snowed-up train, miles away from anywhere. In such a position the language and thoughts of the "kicker" are unprintable, and only fit for transmission to general managers in the shape of telegrams.

Presumably, in order to dispel a little of the general ignorance with regard to railway working, the *Pall Mall Gazette* prints, in a recent issue, a readable article entitled "In the Signal Cabin," in which the duties of signalmen, and some of the apparatus they operate, are lightly sketched. After picturing the signalman as lamenting his position, in so far as it debars him from participation in the "ubiquitous tip," the writer passes to a description of the apparatus employed, commencing with the notice boards exhibited outside the cabin in order to call attention to defects in the apparatus, which he wrongly describes as for "the attention of drivers." The lever frame, the colours of the levers and their meaning, the block instruments and their position, and the usual plan of the lines controlled from the cabin all engage his attention, but he makes a slip in stating that the white levers are for use in case of breakdown of other levers. Such levers are intended for use should subsequent alterations necessitate additional working levers, and, until brought into use, are not connected with the locking of the frame.

In referring to the difference in tone between the two bells, the writer erroneously apportions them to "the up and down line respectively," and after describing the operations involved in the signalling of a train through successive sections, we have a *popular* definition of the fundamental principle underlying the "world-famous block system which, to furnish a simple parallel, decrees that no train may leave the bottom of a flight of stairs until both the latter and the landing beyond have been guaranteed clear." How simple it all is! Surely there will *now* be no reason for anyone to make ridiculous remarks in relation to railway signalling. All that it is necessary to do is to see that the stairs and landing are clear before allowing the train to ascend the former, and—there you are.

"Signalmen," it is stated, "have to keep their cabins in the most spick and span condition. The handle-bars are polished like cavalry chargers' bits; not a speck of dust must rest on the electrical instruments, the floor is washed and scrubbed every morning, and the stove neatly blackleaded." H'm. Sometimes they are; sometimes, however, they are not. In some cases the uses of a door mat will be pointedly referred to, and should you have occasion to touch the levers, a cloth will be handed, so that their lustre may not be dimmed by contact with a moist hand. This, however, is by no means invariably the case. One has heard occasionally from the inspector such remarks as "I can *nearly* see through your windows this time ——." Sometimes a man is mated with another who was born with a tired feeling, and in time the first named gets tired also. Sometimes "relations are strained," and occasionally one may see half the windows cleaned, half the hearth whitened, half the grate blackleaded, half the levers bright, half the floor clean, and the remaining respective halves otherwise. Signalmen are but human. Some of them are very human.

The writer has also a little to say respecting fog signalling "in the small hours of the night," and pictures the station master as "rushing out to knock up the 'foggers,'" while "our friend," the signalman, "has a few minutes in which to decide whether he is justified in taking the precautionary measure of stopping all trains as they approach his box." In this word picture the writer shows himself a true artist in that he leaves opportunities for his readers to fill in the details as their imagination may suggest.

Smoke Abatement.

The City of London Electric Light Company has again been savagely fined by Mr. Slade for emitting smoke at Bankside, and again we feel it our duty to enter a protest against what has now become distinctly unfair. If the company cease to supply current they will be fined under the Electric Lighting Acts, and they cannot supply current without making smoke, pending such time as their furnaces are altered. Let it be granted that an error was made by the company's original advisers in respect of their steam boilers or furnaces, and it still remains unfair to punish them, seeing that they are engaged in remedying the defects. Such defects cannot be made good in a day. Time is essential, and this is not being allowed in reasonable and sufficient amount, nor in a judicial spirit. In the meantime the Smoke Abatement Society continues to potter along. We confess to having little respect for this society. Its members do not seem to be specially qualified to deal with the question on technical grounds, and they appear to have little care for English industries. Is it not time that something was done to protect the interests of trade and industry against the raiding of leisured faddists? The City Company showed that out of 32 furnaces they were now reconstructing no fewer than 18. How is it possible to do more? Is it possible that we have magistrates on the Bench who think furnaces can be altered in a day or while at work? It would appear so from the course taken by Mr. Slade. Justice should at least be tempered by common sense, and to act as London magistrates are now acting savours of an absence of knowledge which should not be the case where large interests are at stake.

NERNST LAMP v. THE ARC AND INCANDESCENCE LAMPS.

By JOHN I. HALL.

(*Concluded from page* 407.)

It will be understood that the reference herein made to the "carbon lamp" means the incandescent lamp at present in use. It is, of course, partly the object of this article to point out in what situations the Nernst lamp may or may not supersede the enclosed carbon lamp.

The promoters take a comprehensive view, and claim a general all-round ascendency for the innovation. This sort of superiority is usually well-defined, is a special feature in the characteristic curve of inventors, is not unknown to company promoters, and figures in many cases as the principal item in the prospectus to enchant the investor. Unfortunately it is not very valuable in liquidation as an asset. This superiority claimed by the Nernst Electric Light, Limited, is set forth in the prospectus, as follows:—

"....The Nernst electric lamp must in many cases put the existing lamps entirely out of competition, and that it will be in great demand for the lighting of streets, mines, factories, mills, steamships, railway stations, sidings and carriages, wharves, public institutions, places of worship, theatres, music halls, shops, hotels, restaurants, &c., &c."

And not a bad claim for a lamp which is only in its experimental stage. For lighting narrow streets the arc lamp is not suitable. Electrical engineers have desired to have a substitute, but have not found any advantage in the carbon lamp for streets over gas, hence it has not been adopted to any great extent.

But now, for the same expenditure of energy, there has been devised a lamp to supersede the carbon lamp, and it is to be hoped that street lighting will be considerably extended in consequence.

In lighting streets by means of carbon lamps, the series system is generally adopted, two lamps being arranged on each pillar, in connection with a very simple automatic device, so that if one or both lamps give out, the continuity of the circuit is not broken.

In adopting Nernst lamps for streets, it will be advisable to run them in parallel, because if run in series, there would be great risk of failure of some of the apparatus, as the lamp consists of—

(*a*) The incandescent body.
(*b*) The steadying resistance.
(*c*) The automatic lighter.

The first cost would also be against it, if arranged in series, to make it as reliable as a series carbon lamp system.

A suitable E.M.F. to adopt would be 500 volts for street lighting, as this voltage could also be safely used in buildings.

While it is suitable for narrow streets, &c., exception can be taken to some of the situations mentioned in the prospectus:—

Where is the colliery manager who would put a naked electric lamp in his mine? It is the custom to put all sorts of safeguards around the lamps.

What railway company will replace or instal lamps at their stations and sidings which, to give as much light as the arc lamp, will cost treble the amount for maintenance, and how many railway companies are there who have electric light in their carriages? I may point out, however, that there is an opening for a 500-volt lamp in street railway (tram) cars.

Some factories and mills will undoubtedly be illuminated by the Nernst lamp; but the incandescent system is not by any means the ideal system of lighting for factories, workrooms, mills, and other works of various kinds. The ideal system is undoubtedly by means of inverted arc lamps. Apart from its being the best method of illumination, it is the safest, as there is no glass to break, and no possibility of fire from hot carbon dropping down.

It may be safely said that in many situations claimed by the promoters, the Nernst lamp will not so easily put the existing carbon lamps out of competition, however it may succeed in the other places enumerated in their prospectus. There are not many jewellers, hosiers, and drapers who will endanger their stock by using the Nernst unprotected lamp; in fact, it could not be used in the same manner as the enclosed carbon lamp to obtain the window effect, which counts for a great deal in these establishments.

An examination of the cost of installing and running the Nernst lamp will reveal circumstances in its favour.

Take the Nernst automatic lamp at a cost of £1, and the carbon lamp at 1s, it is evident that without there are corelative advantages, it cannot compete with the latter.

Against this disadvantage in cost there is the question of fittings, conductors, and maintenance to be taken into account, and it is here that the Nernst lamp will have the advantage in the lighting of public halls, restaurants, large rooms, shop interiors, theatres, &c.

For comparison, let the case be taken in estimating for a section of five 16-C.P. carbon lamps absorbing 300 watts with 3 amperes on 100-volt supply circuit employed for lighting a public hall. There would be a total of 80 C.P. to be replaced. These five carbon lamps could be superseded by means of two 60-watt Nernst lamps absorbing 120 watts at 1·2 amperes.

Now as to the relative cost of the fittings for these respective lamps, presuming them to be controlled from one switch.

	£	s.	d.
Five carbon lamps at 1s.	0	5	0
Five fittings complete, 7s.	1	15	0
Conductors and casing, at 6d.	1	10	0
One switch and cut-out	0	5	6
Sundries	0	2	6
Labour, at 7s....	1	15	0
Total cost, say	£5	13	0

	£	s.	d.
Two Nernst lamps	2	0	0
Two fittings complete, with clear or frosted globes, at 7s.	0	14	0
Conductors and casing (average lengths longer), 8s. ...	0	16	0
One switch and cut-out, say...	0	5	6
Sundries	0	1	6
Labour, at 10s.	1	0	0
Total cost, say	£4	17	0

The economy in favour of the Nernst would, therefore, be well worth securing.

The cost of maintenance for current for five carbon lamps absorbing 150 units during 500 hours at 6d. per unit would be £3 15s., and for the two Nernst lamps absorbing 60 units at the same rate would be £1 10s. Thus, for illuminating large rooms, there will evidently be a considerable economy both in the cost of installation and maintenance in favour of the Nernst lamp.

To summarise the above:—

				£	s.	d.
Installing five carbon lamps...	=	£5	13	0		
Cost of current for 500 hours	=	3	15	0		
				9	8	0
Installing two Nernst lamps...	=	£4	17	0		
Cost of current for 500 hours	=	1	10	0		
				6	7	0
Or showing a balance of				£3	1	0

in first cost, and maintenance for so short a time as 500 hours.

This is pleasant to the contractor, and especially so to the consumer, and it is to be sincerely hoped that the automatic lamp will soon become less in price than one-eighth the cost of the arc lamp as mentioned in the prospectus; which figure I have taken the liberty to increase to one pound (£1), not wishing to take too low a figure for estimating.

The automatic lamp was selected for comparison, because in large rooms, public halls, theatres, &c., where the lamps are more or less out of ordinary reach, the non-automatic lamp could not conveniently be employed.

The price of the automatic lamp is prohibitive for private residences, and the cost would not be in the same proportion as the above prices. The construction of the Nernst lamp, and protection from risk of fire, is an important matter. From the description by Mr. Swinburne of its action when the rod is burning out (p. 261, Electrical Review, February 17th), it is plain that the lamp must be enclosed in a globe, for he states:—

"Probably there was a gradual tendency for the rod to get uneven; then it would get more heated in one part, and softer, until at last it melted." The incandescent rod should

be fastened to the holder in a sound and mechanical fashion, at the same time being as easy of replacement as the ordinary carbon lamp, so that when the rod is burned out it will not become loose and drop down from the contacts.

It will be noticed that as a globe is necessary the non-automatic or match-assisted lamp would be a great nuisance, for it would be necessary to take off the globe, which is a practice that is not necessary with carbon lamps, nor in gas lighting, and Mr. Swinburne's statement cannot be accepted so freely as given, when he says (p. 260, ELECTRICAL REVIEW, February 17th), "There are many cases in which it will be quite satisfactory to have one lamp with an automatic lighter to show you the way into the room, the rest being lighted with a match or spirit lamp as needed."

There is the question of systems of distribution to be considered. "Once the Nernst lamp becomes so general that systems of distribution are laid out to suit it, instead of to suit the carbon lamp, the carbon lamp is practically out of the running" (p. 260, ELECTRICAL REVIEW).

It is very satisfactory to look the future plainly in the face in this manner, and to entertain lively anticipations of systems being laid out to suit a speciality.

But municipal engineers cannot jump about from one system to another, like a cat on hot bricks. There has already been one jump from 100 to 200 volts, and this is enough for many users of electricity to put up with for some time to come.

The municipal engineer must have some more consideration for the customers than to compel them to change the lamps and put them to needless expense. It would not only be the cost of changing the lamps but the holders, and in many cases, main switches and fuses would require replacing.

The switching and controlling apparatus of the L.T. supply systems would likewise need some modification. Further, if systems are changed or laid down to suit the Nernst lamp it would be giving that lamp a monopoly, and, in the interests of the consumer, it will be preferable to lay down systems where monopoly will not exist; and therefore for some years at least it will be advisable for the Nernst lamp to adapt itself to the present systems. If the lamp is adopted to any great extent for street lighting, the engineer can use any voltage he thinks fit.

It is apparently not the only lamp that will have a lower consumption of energy than the 60-watt 16-C.P. carbon lamp. Improvements are taking place in the manufacture of incandescence lamps. The carbide of silicon lamp (p. 361, ELECTRICAL REVIEW, March 10th), also appears to be an improvement. The lamp is said to consume 2·5 watts per C.P. This is not so satisfactory as 1·5 watt per C.P., but still it shows that the wind is blowing in the right direction, and improvements are in the air, and incandescent lamp makers will undoubtedly be stirred up to study in what direction they can improve in lamp manufacture, and as the Nernst lamp at present is only a short-lived one, the high efficiency carbon lamp may come to the front.

It may be asked in what systems will the Nernst lamp oust the carbon lamp?

Prof. Ayrton said, during the discussion on Mr. Swinburne's paper, "He understood from his colleague, Dr. Armstrong, who visited Prof. Nernst some time ago, that it was essential to use an alternating current, as with a direct current the incandescent rod soon ceased to make good contact with one of the platinum terminals." If this is the case, then, the Nernst lamp will be confined to the alternating systems, and these are in a minority both in regard to the number of stations and lamps connected as shown below.

At present there are in Britain about 82 stations on the direct current system and 74 stations on the alternating system. These stations have approximately 2,342,000 and 2,166,000 incandescent lamps connected to their mains, the average being about 29,000 per station for either system.

If the Nernst lamp is only suitable for working on alternating current systems, and the tendency in electrical engineering is to instal direct current plant, then Mr. Swinburne's dream of distribution systems to suit the Nernst lamp appears likely to be associated with the dim and hazy future.

There are many points that require discussion in connection with this subject, and only a few have been lightly touched on in this article.

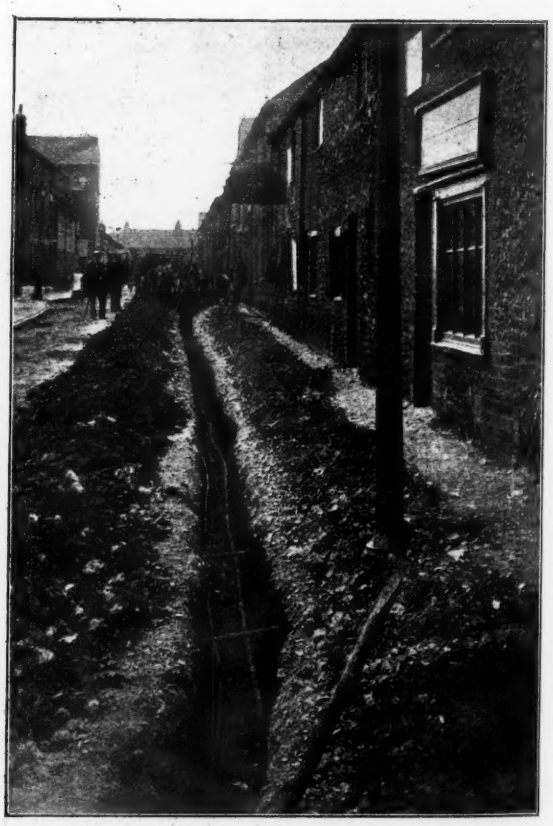
The object of this criticism has been to examine the claims of the Nernst lamp, and although instances have been given of a favourable nature, yet there are many others which point to the fact that the Nernst lamp has a field, but of a more limited nature than has been claimed for it.

ERRATUM.—The last sentence of the first paragraph on page 406 should read 1,800 watts = 1·8 kilowatts per hour, which will cost to the consumer 5·4d. per kilowatt per hour, and this figure should be substituted in each case for 3·6d.

HIGH WYCOMBE ELECTRIC LIGHTING.

ON Wednesday, March 1st, was performed the ceremony of formally opening the High Wycombe Electric Light Works.

Earl Carrington, who was announced to preside, was unable to fulfil his intention, his lordship having to attend a meeting at Marlborough House. Mr. H. L. W. Lawson therefore consented to deputise for the noble lord, and the ceremony was of a simple character. About one o'clock the company began to gather in the engine room of the electricity works. Besides Mr. Lawson, there were present: Messrs. F. E. Gripper (managing director of Edmundsons'



LAYING MAINS.

Electricity Corporation), Alfred Slatter, and Walter Birch, directors of the new company; Mr. E. Salthouse, secretary and engineer; E. Dewar, assistant engineer; Messrs. T. O. Callender, T. Parker, J. C. Peache, J. C. Wigham, Edmundsons' managing engineer; G. Sanderson, F. E Proctor, and E. Lazeby; the Mayor and Mayoress of Wycombe (Mr. and Mrs. C. W. Deacon), Councillors R. D. Vernon, R. S. Wood (chairman of the Electric Light Committee), H. Flint, C. T. Baines, F. J. Howland, R. Howland, jun., O. Nash, and W. B. Gibson; the Rev. E. D. Shaw (vicar), Mr. B. L. Reynolds, Mr. A. J. Clarke (town clerk), Dr. Bradshaw, Mr. Philip J. Rutland, Messrs. G. T. Miles, W. Peacock (postmaster), Dodds (station-master), T. Thur-

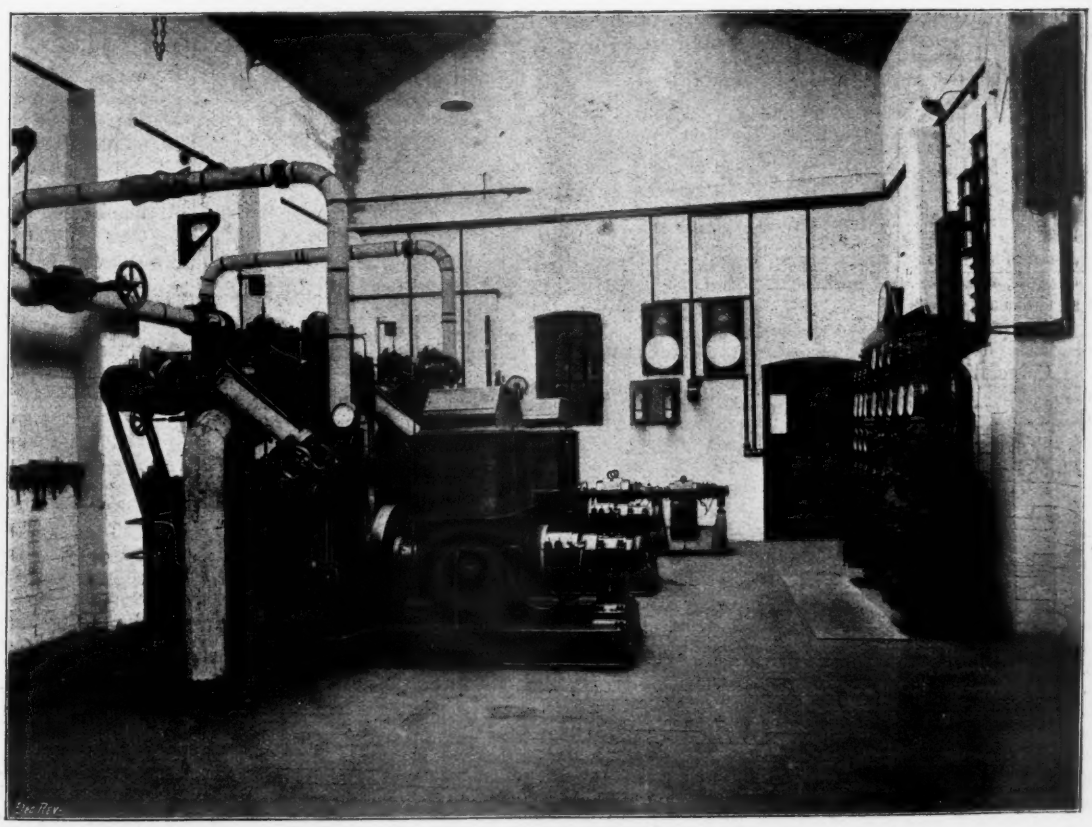
low, W. T. Pycraft, Berry, T. J. Rushbrooke (borough surveyor), W. Howland, Green (Capital and Counties Bank), Theobald, C. Pierce, H. T. Dickens, F. Skull, Rogers, B. Woodbridge, W. H. Kirby, H. J. Cox, C. Birch, C. H. Hunt, jun., C. E. Skull, R. Birch, E. Birch, T. Phillips, Spicer, Gwillim, Fletcher (London), Supt. Sparling, and many ladies.

Laying Mains.

Mr. Lawson said the inauguration of the electric lighting and supply works stamped High Wycombe as being in the van of municipal progress. Lighting — good lighting — was the foundation of municipal government, and as it was the foundation so it was now the test of its efficiency. It gave him great pleasure to know that not only would Wycombe have the advantage of a good supply of light and power for the next seven years, but afterwards, if it chose to enter into possession of its inheritance, the company would allow them to do so on terms which were equitable and fair to all concerned. That seemed to him to be the most satisfactory solution of the question of public as against private enterprise, of which they had heard a great deal on the great body with which he had been connected. He trusted and believed it would be to the mutual benefit to both Corporation and company.

Mr. Wigham, having conducted the company round the establishment and described the working of all the appliances, Mr. Harry Lawson then asked the Mayoress to switch on the electric light of Wycombe.

Councillor Wood said the pleasing duty fell to him of asking the company to tender thanks to Mr. Harry Lawson, who had so kindly come down to fill up the gap caused by the absence of Earl Carrington. That day was the opening of another chapter in the municipal history of Wycombe, and it was a red-letter day so far as Wycombe and the house of Lawson was concerned. The latter were near neighbours, and as municipal activity progressed, so they liked to see the sires and the sons of sires of that house joining Wycombe and taking part in her functions. They had heard the name of Lawson mentioned over and over again, and he was sure



The Generating Plant.

that that day they had had with them a worthy son of a worthy sire.

The Mayor said the introduction of that light was an evidence of the growth of the municipal life of the borough. They were grateful to Mr. Lawson for coming in the place of Earl Carrington, whom nothing but a Royal command would have kept away. He would like to congratulate the company upon the complete manner in which the works had been erected, and he was sure that after the instructive description given by the engineer they would be wiser than when they came. He was glad to have been first in the scheme so far as the provisional order was concerned, and he was glad that during his year of office the light was used in the streets.

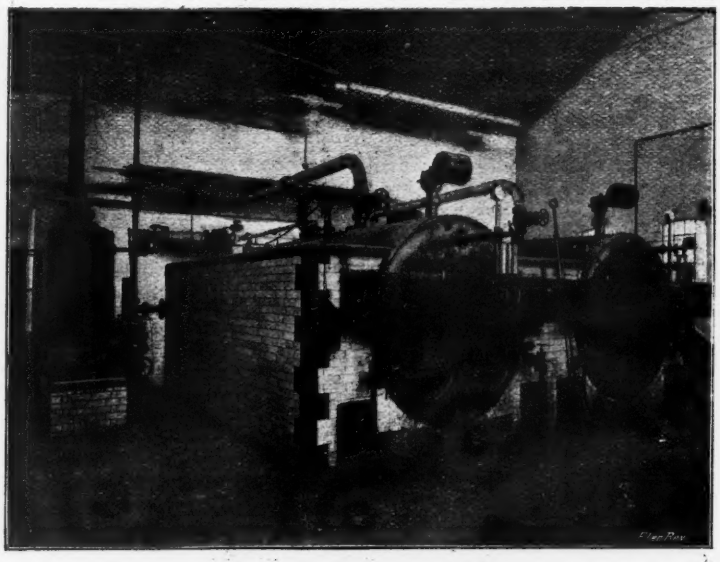
Following is a description of the works:—

Branching off the Great Western Railway main line at Maidenhead, a run of some 6 miles up one of the picturesque and fertile valleys of Buckinghamshire brings the traveller to the town, the electric lighting of which forms the subject of the present article.

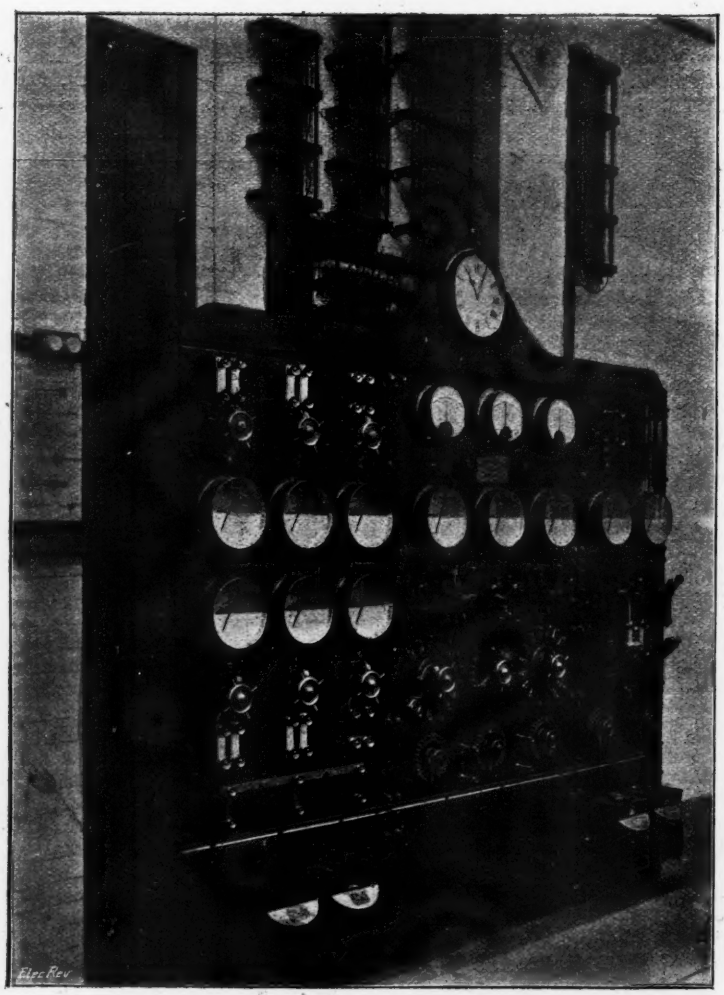
The Corporation obtained the provisional order in 1894, but not being in a position to carry it out, they decided to transfer to a local company, and after negotiating with several people, eventually agreed to part with it to the present company, which was formed by Edmundsons' Electricity Corporation, by whom the entire work has been carried out.

Wycombe is the chief seat of the chair industry in Great Britain, there being about 94 factories, large and small, engaged in this work, or allied trades, and among these the company expect to secure a motor load larger in proportion to the lighting load than falls to the lot of most undertakings.

The population at present is about 22,000. The Great Western Railway have lately secured powers to run a new line from Wycombe to Acton, which will bring the town within 35 minutes of London by fast trains; this will no doubt beneficially affect the progress of the borough.



Boiler House.



The Switchboard.

It was one of the provisions of the transfer that the Council should adopt electricity for the street lighting, and to-day the whole of the roads are so lighted by 5 arc lamps and about 200 incandescents; the Town Hall and Police Offices are also lit under the same agreement.

Another clause compels the company to wire any premises free and accept payment for the same at the rate of 9d. per lamp per quarter until the cost is worked off, no interest on the money expended being allowed; this should insure the connection of a large number of smaller class houses, in which class a majority of the premises in Wycombe may be included.

The company are taking up this work in a spirited manner, and are also offering arc lamps and motors on hire at easy rates.

The works are centrally situated, have plenty of room for extension, and water for condensing. Coal is reasonable in price; the station is equipped with first-class economical plant. We venture to predict for the undertaking a successful career.

The following were Messrs. Edmundsons' chief sub-contractors:—Boilers and engines, Davey, Paxman & Co.; piping work, Babcock & Wilcox; dynamos, balancer booster set, Thomas Parker; pumps, Worthington Pumping Com-

pany; feed heater, Joseph Wright; switchboard, Edmund Charrington; accumulators, D.P. Battery Company; meters, Ferranti; demand indicators, Reason Manufacturing Company; cable, Callender's Cable Company; buildings and chimney, Henry Flint, High Wycombe.

The site of the works is as nearly in the centre of the town as possible, and, being three-quarters of an acre in extent, there is ample room for extension. Being hid away behind cottage property, no trouble has been taken to ornament the buildings, which are, however, lightsome, and well adapted for a supply works, and care has been taken to leave ample provision for extensions.

In sinking the foundation for the chimney, water was met with 2 feet from the surface, and steam pumps had to be kept at work day and night until the foundations were in; these were laid on a bed of very hard flint gravel, and all the ballast for the concrete of the foundation, engine beds, &c., was obtained on the site.

From this vast underground reservoir will presently be drawn the water for condensing purposes.

The chimney is 120 feet high, the internal diameter being 5 feet square.

The plant at present erected consisting of two Davey, Paxman economic boilers 12 feet 6 inches × 7 feet 6 inches, having a heating surface of 665 square feet, and built for 160 lbs. pressure.

A pair of Worthington feed pumps and one of Joseph Wright's excelsior feed water heaters and duplicate feed piping with valves to cut off any defective portion, complete the boiler house plant.

The engine house plant consists of two "Peache" high speed engines F C type, 120 I.H.P. at 480 revolutions coupled direct to two Parker dynamos, 160 amperes at 420 to 460 volts.

A 5-inch ring steam main of lap-welded steel pipes with heavy flanges screwed on and brazed and Hopkinson's valves.

A balancer booster set, the balancer armatures being wound for 50 amperes at 210 to 230 volts, and the booster 70 amperes at 10 to 70 volts.

230 D.P. cells in glass boxes F type 585 ampere-hour capacity, at 55 amperes, and capable of giving 80 amperes for 4 hours.

Switchboard of enamelled slate divided in three panels, on the left hand being the feeders, the right hand the dynamos, and in the centre the middle wire, balancer, and accumulator panels.

The whole of the mains are Messrs. Callender's fibrous type, lead-covered and armoured, with one exception, the feeders being triple concentric, and the distributor three core.

The following are the lengths as laid at present:—

Feeders, No. 1	...	...	662 yards	·100	·06	·100
„ 2	...	...	321 „	·100	·06	·100
„ 3	...	...	1,020 „	·100	·06	·100
Distributors	...	...	2,480 „	·075	·05	·075
„	...	...	5,060 „	·05	·03	·05
Arc lamps ...	...	...	420 „	·012	·012	·012
Incandescent street lighting			7,750 „	·008	·008	·008
				·008	·008	

As already mentioned, the chief street lighting is by means of incandescent lamps, there being only five arc lamps in use at present, but the question of extending these is now under consideration.

The old gas standards and lanterns have been retained, and the electric lamps are fitted inside the Reason Company's lens reflectors in straight roads, and inside a "Prism" globe, at corners or in crooked streets.

All the lamps are fitted off separate cables composed of ·008, ·008, ·008 three-core lead covered and armoured, tapped off the distributors at various points, in the nearest post to which are fitted the switches for the circuit. These switches are roughly collected together in three groups, and it takes less than an hour for one man to turn them all on or off.

Three of the arc lamps are open type connected between the outer and neutral of the system; the other two are Jandus lamps in series connected in the same way.

The number of lamps connected at the beginning of this year was about 1,800 C.P., which has been increased by nearly 1,000 since, and inquiries are very frequent just now; in several directions new buildings are being erected, and the owners have decided to have them up-to-date and lit throughout by electric light, which shows that the supply is being approved of and augurs well for the success of the enterprise.

The opening ceremony was followed by a luncheon in the Wellington Room of the Red Lion Hotel, at which the directors entertained a company of about 80, largely composed of those whose names are given as being present at the previous ceremony. Mr. H. L. W. Lawson presided, and had on his right the Mayor of Wycombe and Mr. F. E. Gripper (a director of the Wycombe Electric Light Company), and on his left Mr. A. Slatter (also a director of the company) and Mr. Councillor R. S. Wood. Mr. Walter Birch (the local director of the Electric Light Company) occupied the vice-chair.

The station has all the good qualities which characterise everything of this nature which Edmundsons' Electricity Corporation have hitherto undertaken, and which have been fully described and illustrated in our pages, and having said this there is no further need for eulogy on our part, so we conclude by adding our congratulations to the High Wycombe authorities on their enterprise on behalf of that ancient borough.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

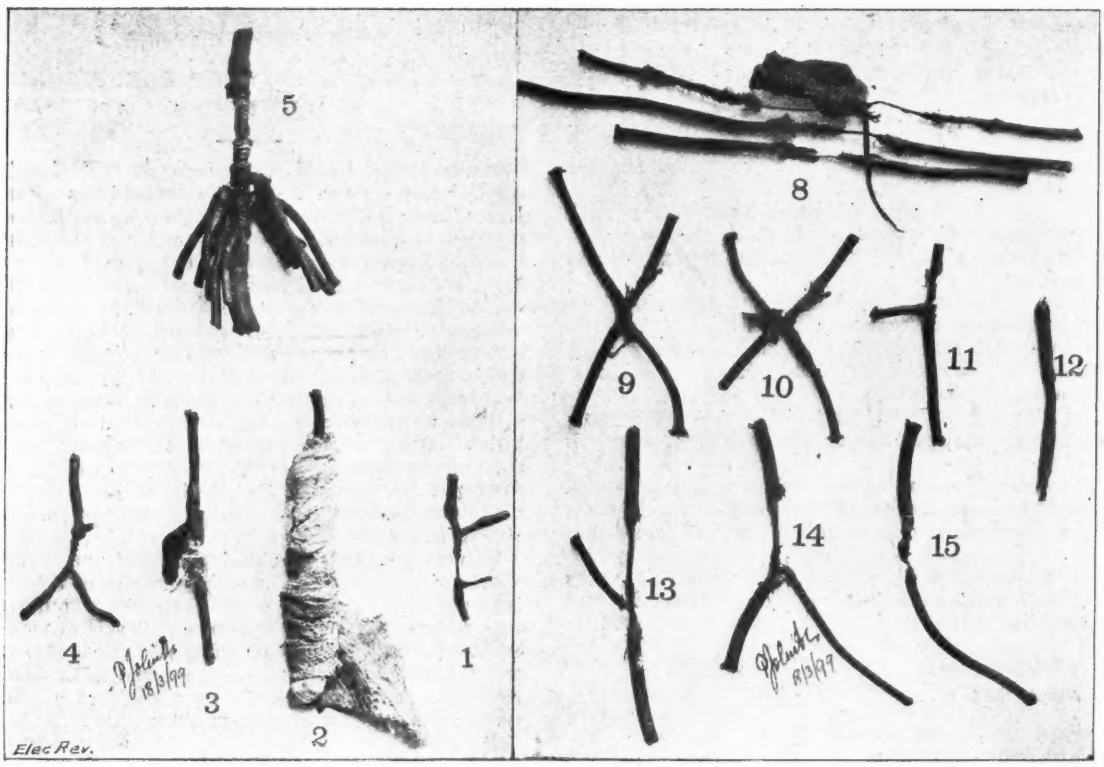
The repetition of Mr. Marconi's paper on "Wireless Telegraphy" took place on Thursday evening of last week in the Lower Exeter Hall, Strand, where again space was strained to the utmost to accomodate the large number of members and friends who anxiously looked forward to hearing Mr. Marconi's views and witnessing the demonstrations of his system. The meeting was, as the President, who occupied the chair, stated, remarkable in that it was held for the purpose of repeating the delivery of a paper already given to the Institution, being an overflow meeting, while it was held in an unusual place, under unusual circumstances, and with an unusually large number present. It might have been added that the fair sex graced the meeting, and this again was exceptional. Mr. Marconi had to relinquish the reading of his paper to Mr. McMillan, the secretary of the Institution, but was fortunately able to be present and to give his reply to the discussion.

In introducing the paper, the President referred to another method of wireless telegraphy—the heliograph of Sir Henry Mance, which depended upon the same general principle—the agitation of the luminiferous ether. The heliograph had been used over a distance of 60 miles, but it required elevated positions and a transparent atmosphere, whereas the Marconi telegraph would work through an atmosphere not transparent; yes, even through a London fog.

The reading of the paper and the demonstrations which accompanied it were well received. On conclusion of this Mr. Marconi replied to the various speakers in the discussion. His reply was admirably put, but as it was lengthy, we will merely summarise the salient points, leaving our readers to refresh their memories of the details by perusal of the full report in the *Journal* of the Institution when it appears. Mr. Marconi thanked the Institution for the way it had received his paper, mentioning that it was his first paper in the English language. He was glad to note that Prof. Fleming's results agreed with his own that a coherer was a satisfactory instrument and that the vertical wire was an advantage. The reason why oil was no advantage in the transmitter was that it seemed as if a continuous discharge made a hole in the oil, thus dots are all recorded, but dashes in a great part miss. When capacity was added to the wire air seemed almost an ideal substance. He had found that the use of mercury was necessary in order to obtain the best results in coherers, and the tubes should be exhausted to 1 mm. of mercury. The tubes used were tested over 18 miles with a moderate length of vertical wire; by using 200 feet of wire instead of 75 feet, non-exhausted tubes could be used, but such a length of wire was rendered unnecessary by exhaustion. Non-exhausted tubes seemed always to gradually decrease in sensitiveness.

In order to obtain the greatest distances with a given height of wire earth connections must be used. The results obtained with a capacity were similar to conductors

in connection with earth, and, as has been noticed by Mr. Gavey, a small capacity may suffice at the receiver, but a much larger capacity is required at the transmitter. The results obtained with the earth connection entirely removed might be explained by regarding the space as the dielectric of a condenser, the isolated capacity is one plate and the earth the other. Extremely small capacities suffice for signalling at the high frequencies dealt with. Likewise signals could be sent over many miles with the vertical wire disconnected; the distance between the end of the wire and the terminal of the receiver might be 1 foot, the wire having a plate 1 foot square attached to it, and signals could be received over a distance of 14 miles. Here the gap acted as the dielectric of a small condenser. There was, therefore, no necessity for the installation at a place like the Fastnet to have what would commonly be called a good earth; a capacity area would be quite sufficient, and the earth terminal might be connected to the boiler-plate building of the lighthouse as no wire had ever been struck by lightning; the numerous instances in Italy, where storms are frequent and severe, showed that nothing need happen. To screen the receiving apparatus it was put in an earthed metallic box with choking coils between the enclosed apparatus and the inker, so as to cut off any stray effects collected by the wires leading to the inker. Intervening hills do not appear to interfere with signals. In reply to Mr. Granville, the use of accumulators is entirely experimental; Obach dry cells are sufficient and last for 10 months to a year; 50 cells were used on the Royal yacht *Osborne* and at Kingston. The conductors should, as pointed out by Prof. Fleming, be parallel to one another. As to coherers, experience had shown that nickel filings, mixed with a very small percentage of silver and mercury give reliability and sensitiveness. Prof. S. P. Thompson's suggestions were novel, and he hoped to have an opportunity of testing if they were quite accurate. Earth connection could be made at the top of a vertical wire by



Some Specimens of Joints.

itself. On the Royal yacht and during Kingston Regatta, the floating station had the vertical wire close to funnels and amidst numerous wire stays, but the apparatus worked all right.

The law of height had already been discovered in 1896, and, in reference to Mr. Gavey's remarks, Mr. Marconi said the question had also been fully discussed in the Italian and technical press. But it was interesting that Mr. Gavey, working independently, should verify the same law. At Salisbury in 1897 a height of 30 feet per mile was found sufficient; afterwards improvements brought it down to 20 feet. Placing the vertical wire on a height is not necessarily an advantage; some of the greatest distances worked over have been without the base being elevated much above sea level.

In connection with reflectors Mr. Marconi hoped to give them attention shortly, but pointed out that for some purposes tinning would be a disadvantage. He thought Mr. Gavey had over-estimated the danger from lightning, hanging it over a cliff, as at Alum Bay, and this might also be done on a lighthouse.

This closed the meeting. Mr. Marconi must be congratulated upon the interest his work has evoked, and deserves thanks for the clear way he has explained what he has done.

SOME SPECIMENS OF JOINTS.

Messrs. P. Jolin & Co., of Bristol, have sent us some photographs, which we reproduce, of a series of joints which they have removed from various buildings in Bristol. It is hardly necessary to say that such work calls not only for drastic rules but for close supervision; even the mouse depicted in the photograph has had sufficient feeling to be shocked at a bad joint.

Figs. 1 and 4.—The only attempt at soldering; which has only taken on the $\frac{1}{16}$ twisted round the $\frac{1}{16}$, but not fluxed through.

Fig. 2.—Joint $\frac{1}{16}$ and $\frac{1}{16}$ tightly twisted; no sign of heating and insulated with *old lace curtain.*

Fig. 3.—Joint two, $\frac{1}{16}$, same as fig. 2, but insulated with *strands of lace* curtain and black tape.

The solder on fig. 1 can be seen on reverse view, and on fig. 4 on front view.

Fig. 5.—Switchboard joint wires badly twisted and partly soldered, black with heating, insulation pure rubber and black tape.

The installation from which all joints, *except* fig. 5, came, had no casing under floors.

Fig. 8.—Three wires run through small hole in wall without casing. Insulation destroyed by mouse, which brought wires in contact and short-circuited switch wire to main. Mouse found dead on switch wire.

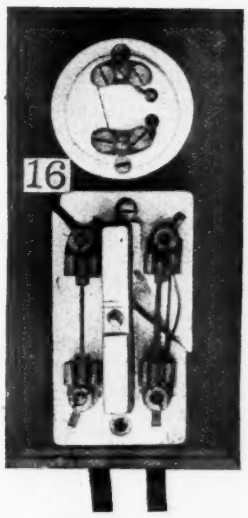


Fig. 12.—7/20 cable, mouse eaten (the cable not the mouse). Figs. 9 and 10, cross joints. Figs. 11, 13, 14, T joints. Fig. 15, attempted splice. All joints blackened by heat caused by loose contact.

Fig. 16.—Double-pole clip cut-out in tandem with main cut-outs. This was in an office with fuses blown, and $\frac{1}{16}$ copper wire double twisted on clips (one side, wire lost). From this cut-out, main and return in fig. 8, went direct for 12 16-C.P. 105-volt lamps, Also flexible for one lamp in office without ceiling-rose, cut-out, or switch, the screw lamp *being turned in its socket* to act as a switch. The short circuit on wires, fig. 8, could not blow the copper wire in fig. 16, but blew main cut-outs.

INDUCTION MOTORS.

There is no doubt that there is a growing demand for single-phase alternating current motors, and within the last few years this has called forth much inventive skill, which has resulted in several good types of machine. But the theory of these motors is by no means simple, or even yet fully understood, and the designing of them is at present a somewhat tentative process. Accordingly there is ample room left for careful experimenting and ingenious constructing. We welcome, therefore, any addition to our knowledge of this rather difficult subject, such as the elaborate investigation described in Prof. Ernest Wilson's paper read the week before last before the Institution of Electrical Engineers. The great difficulty with all such motors is the starting, and Prof. Wilson's experiments were mainly with a view to elucidate the conditions of action of a particular type of starting device. In this the three rotor circuits are led through slip rings to a triple rheostat, as in Ricardo Arnò's system, while, in addition, the main and auxiliary windings of the stator have to be supplied with two-phase currents. By skilfully arranged search coils, curve-tracing devices, and other instruments, the author has obtained a most admirable set of tables giving complete records of the currents, effective fluxes, leakage fluxes, E.M.Fs., torques, &c., with the rotor held at rest under various conditions. We regret to find that these valuable results are left almost inaccessible to the ordinary reader by the want of clearness of explanation throughout the paper. Thus the quite simple bit of trigonometry concerning a pure rotary field is left quite unintelligible by the omission of all the vital argument.

After a short introduction and a set of useful references (mostly without dates, however), the motor which was used in the experiments is described. It was for single-phase alternating current at 220 volts to give about 11 kilowatts at 1,000 revolutions per minute, the frequency being 50 $\sim$ per second. The starting torque was approximately measured by means of a spring balance and a beam fastened to the shaft. We gather from this that the rotor was brought to rest in a definite position throughout all the experiments. The instantaneous values of the various electrical quantities were got by the aid of an electrometer, a revolving contact-maker (on the alternator shaft), and suitable resistance coils. Thanks to the slip-rings it was possible to measure the currents in the three rotor circuits.

The author then proceeds to define the symbols used in the paper; it takes us some time to grasp what he means by the curt phrase "a period of surface revolution." Next follows a diagram showing the probable relative distribution of the magnetic flux at any instant across the air-gap, and this is shown to agree approximately with the actual values of the flux measured across certain areas by means of search coils. These last consisted of a series of thin wires stretched across the bored surface of the stator parallel to its axis, and, we should imagine, all bunched at one end. When the auxiliary winding alone was used with single-phase current, it was found that serious magnetic leakage occurred across the teeth, amounting to 24 per cent. in one experiment. By assuming a leakage coefficient of 1·5, it was found possible to calculate (with fair accuracy) the total magnetic flux from the reluctances of the several parts and the M.M.F. due to the exciting current, exactly as is done in the case of a direct current dynamo.

Next comes the short mathematical digression upon which we have remarked above. To one who can read a great deal between the lines the mathematical result is that with simple sine curve currents of any number of phases, it is possible to obtain a pure rotary magnetic field; but that if the currents do not follow sine curves, a pure rotary field is unattainable (with such a system of winding at least).

We think, however, that with iron in the circuits, the *fluxes* might in some cases nearly follow the sine law, even when the *currents* did not. This is often the case with a transformer whose secondary winding is on open circuit if the primary voltage is sinusoidal.

The next experiments were made with two-phase currents, both the main and auxiliary windings being used. The magnetic leakages were found both for open and closed circuits of the rotor, and when various resistances were also inserted. As with single-phase excitation these leakages were found to be considerable. A formula is then obtained for the torque on the rotor when held at rest. It may be stated thus:—

Mean torque (in dyne-cms) $= 10^7 \times$ (mean watts in rotor circuits) $\div$ (speed of field at the air-gap).

The mean power in the rotor circuits was got from the curves of instantaneous values of currents and E.M.Fs., and the corresponding values of the torque were thus calculated for the various values of rotor resistance. They agreed as well as could be expected with the values actually observed by the aid of the spring balance.

The author then proceeds to locate the dissipation of energy, and mentions a large amount of power lost by waste field as distinct from hysteresis and eddy current losses; but surely the whole of this power is ultimately spent in heating the iron and copper. The variation of the torque over a half period is exhibited in three interesting tables, which show that when the rotor resistance has the critical value which gives maximum torque, the torque during a period does not vary by more than about 11 per cent. from its mean value; while for larger or smaller resistances the irregularity of the torque is much more marked, being nearly 60 per cent. from the mean in one case. Collected results are also given for the phase difference between rotor and stator currents, and these show, amongst other things, that the currents are farthest out of phase when the starting torque is greatest. A set of tests at a frequency of 95 $\sim$ per second (and a higher voltage) showed that the maximum

torque could be got with much the same value of the critical resistance as that for 52 ~ per second. This would allow the same triple rheostat to be used for various frequencies.

The paper concludes with an examination of the effects of armature reaction, but these are rather too complicated to be explained in this short summary.

From the numbers given in the paper, it is clear that the maximum torque obtained by the complicated gear described above could not start the motor when on full load, and therefore a friction clutch or a loose pulley would have to be used. In cases where these are allowable, it seems much simpler to omit the slip rings and resistances, and to work with closed circuits in the rotor. This is done, for instance, in the Langdon-Davies motor, and there is no difficulty in obtaining a starting torque of about one-fifth of the full load torque, without taking an abnormally large current.

To obtain this, however, initially a rotary field is used for which an auxiliary winding of high inductance is required on the stator, the main winding being rendered less inductive by a resistance added only for starting. In Arnò's system (with slip-rings and three-armed rheostat) no auxiliary rotary field is required, but the motor must by mechanical means be brought up to a certain small speed before it will give sufficient torque to run the belt and the loose pulley.

In conclusion, we hope Prof. Wilson will proceed to a similar research with the motor running under various loads, and we shall feel the more grateful to him if he will try to present his interesting results in a clear and easily understood form.

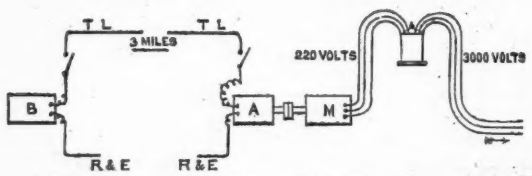
CORRESPONDENCE.

Notes on Three-Phase and Tramway Work.

I notice in your issue of January 20th, just to hand, a somewhat incomplete description is given, without permission, of part of one of the plants under my charge and supervision, viz. :—"Notes on Three-Phase and Tramway Work."

Your writer asks for the reason of certain actions of the plant, and for convenience I reproduce the sketch of connections as given, with the following explanation of the effects that were observed, and would refer your writer and readers for a full description of the plant and the different effects it has on the whole of the three-phase system to a paper which I am about to submit to the Institution of Electrical Engineers.

It is quite evident that when tramway generator, B, tends to run away, not having any governors on its Pelton wheel it drives the generator, A, as a motor at an increased speed



T L, Trolley line; B, 600-volt tram generator driven by Pelton wheel; R & E, Rails and earth; A, 550-volt tram generator; M, Three-phase motor started up with rheostat in rotor circuit; T, Transformer; →, To the three-phase circuits and installation.

somewhat higher than the synchronous speed of the three-phase motor M to which it is coupled, and so alters the "slip" of the rotor circuit from a "negative" to a "positive" effect, thereby generating power in the main fields, to be given off to the three-phase system, but not necessarily altering the "lag," or the wattless currents, going through the main fields, therefore the slight change noticeable on the ampere-meter readings.

W. Elsdon-Dew.

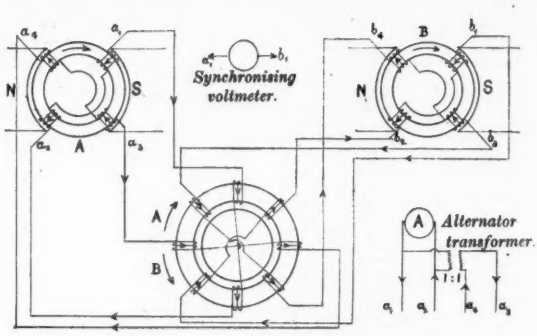
Pilgrims' Rest, Transvaal,
February 22nd, 1899.

P.S.—It is therefore quite evident that if M is disconnected from the three-phase system the tramway section will race, and also if a resistance is introduced into rotor circuit the effect is somewhat the same—M will not generate efficiently, and is similar to reducing the excitation in synchronous motors.

Synchronisers.

The following arrangements for a synchroniser are given in the hope that the opinion of central station engineers will be expressed on the subject

Suppose two alternators, A and B, to be considered. They are two-phase machines, A is running, and B the incoming machine. Let A be connected to one of two sets of windings on a little induction motor, which will be driven in a certain direction. If B is now connected to the other set of windings so as to drive in the opposite direction, the net result, supposing the voltage, frequency and other factors to



be alike should be a stoppage of the motor, and any rotation of the latter ought to show by its direction the faster alternator of the two. A much simpler arrangement would be to connect a set of lamps in something of a similar way to the synchroniser described in the Electrical Review of February 24th, pp. 318-9.

To adapt any method of this kind to single-phase machines it would be necessary to use a phase-splitting device of some kind. Let an equal ratio transformer be connected to the alternator. Then the secondary terminals could provide one phase while conductors from the alternator terminals would give the other; as the secondary E.M.F. induced in a transformer is a least 90° behind the primary E.M.F.

The opinion of your readers as to the feasibility or otherwise of this plan would be welcome.

John C. Lucas.

Electric Lighting Department,
Technical School, Handsworth.

High Voltage Circuits.

In answer to your correspondent, Mr. E. Bennett Viles, in this week's Review *re* lamps in series on "High Voltage Circuits," I most strongly recommend him, both for his and the consumer's sake, and from my own personal experience, *not* to try lamps in series, unless he wishes to court trouble.

I have *had* several billiard fittings wired for two lamps in series on 220 volts; these lamps were continually burning out, and all lamps used were specially selected, both for same C.P. and efficiency.

All these fittings are now wired for lamps in parallel (and lamps pointing down). Also in ordinary S.B.C. candle lamps I run in parallel, as I have found where several different C.P. and voltage lamps are used, the consumer will very soon get into trouble.

Frank G. Mahon.

The Wehnelt Interrupter.

If in the Wehnelt interrupter we substitute for the lead plate a large globule of mercury for the dilute acid distilled water, and for the platinum electrode an aluminium wire, brought sufficiently close to the mercury to cause a small arc under the water, we have a form of liquid interrupter which will work with a low voltage and small current. The mercury must not be too clean, and the anode must be of aluminium.

When the interrupter is working properly, it gives out a loud musical note.

E. Bennett Viles.

Perhaps the following may be new to some others who are using Dr. Wehnelt's interrupter. In experimenting I connected the interrupter with the 100-volt circuit without any coil. It then refused to work, one bubble just being off at the moment of making contact.

Further experimenting shows that self-induction is required to make the break work. Perhaps the action is on this wise. On the current being switched on, the positive pole is immediately afterwards insulated by a layer of oxide and the current ceases. The counter current induced in the coil can then act, and for a moment converts the positive pole into a negative one, absorbing the oxide and setting free a little hydrogen, and so the action goes on.

That this is the case I found by collecting the gas given off from the "positive" pole and applying a light, when there was a brisk explosion, leaving, however, a considerable amount of oxygen and ozone in the tube.

Alex. Hill, A.I.E.E.

In view of the interest excited by the Wehnelt electrolytic current interrupter, perhaps I may be permitted to call attention to the fact that an electrolytic method of operating the primary circuits of induction coils was described by Sprague in 1884 in the second edition of "Electricity: Its Theory, Sources, and Application," at page 537. He says: "The mercury itself can be made to break the circuit if a platinum wire serving as the + conductor just touches it, and the mercury is covered with water containing a little acid; action occurs similar to that which actuates Lippmann's electrometer; a film of gas forms, and the mercury leaves the point, returning again immediately to repeat the process."

H. J. Coates.

New Repeater for Telephones.

Many inventors have tried to devise means by which telephonic messages might be repeated from one circuit into another, in order to permit conversation over greater distances than would otherwise be possible. But little success in this regard has hitherto been attained. All telephone repeaters, except that about to be described, use the diaphragm of a receiving Bell telephone, or its equivalent, to vary the pressure in a microphone transmitter at the end of the second circuit, and so cause a repetition of the message in this circuit. Nearly all the telephone repeaters hitherto invented can be used only in repeating messages from the first circuit into a second. Few or none can repeat from a second into a third circuit, and so on, through an indefinite number of circuits, in a manner similar to repeating through an indefinite number of telegraphic circuits.

Telephone repeaters have usually been unsuccessful, because, although the diaphragm of the transmitter vibrates with considerable amplitude, the diaphragm of the receiver vibrates with an amplitude so small that it is not manifest to the sense of touch. Hence the variation in pressure on the carbon transmitter of a repeater is very small, and, in consequence, the telephonic message in the second circuit, if audible, is very weak even in short circuits.

In the new telephone repeater a telephone receiver, which speaks more loudly than a person, is used. This loud-speaking receiver was invented by Mr. Edison more than 20 years ago. It is called the motograph. It consists in a cylinder of plaster of Paris moistened with a certain solution. Pressed against the face of this cylinder is a strip of platinum, the other end of which is attached to a diaphragm. One wire is connected with the platinum spring and the other with the cylinder. On turning the cylinder steadily by hand, or other motor, the strip is drawn forward by friction on the cylinder, or released, according as a current passes or not, and according as a stronger or a weaker current of electricity passes through the chemical solution between the platinum spring and the cylinder. The sound of the receiver is dynamically caused by the motor which turns the cylinder. It is more difficult to turn the cylinder when receiving a message than when the line is idle. The electric current merely controls the vibrations of the diaphragm, which throws the atmosphere into acoustic vibrations, representing the voice of the sender. This motograph has been little used, because the Bell receiver which is simpler speaks in a sufficiently loud tone for common use.

It recently occurred to the inventor of the new telephone repeater that by using Edison's loud-speaking receiver, or motograph, near the carbon or other suitable transmitter of a second circuit, a message spoken into the first circuit would be repeated with undiminished force into a second circuit. At the end of the second circuit a repeater may be used to forward the message into a third circuit, and so on. The number of repeaters will be one less than the number of circuits. At the end of the last circuit a Bell receiver may be used if desirable. By a suitable duplication of transmitting and receiving parts in each repeater telephonic messages may be sent in either direction automatically. A small electric motor will be suitable for driving the cylinder of each repeater during hours of business.

The invention is automatic, and all parts of one or more continents would be brought within speaking distance. The reproduction of a speaker's voice, even at the opposite side of a continent, would be louder than the voice itself, because the voice at each repeater is dynamically due to the motive power which turns the cylinder. The reproduction of the voice at the end of a dozen circuits would be as loud as that at the end of the first circuit.

Nothing would now prevent us from recording a phonogram, even at a distance of thousands of miles. At the end of the last circuit a phonograph may be set before the motograph receiver, and since this will speak as loudly as the person sending the message, the phonogram may be impressed as deeply on the wax cylinder as if the speaker were present. The phonogram tube may be detached from the phonograph and sent to the person addressed, who may, at his leisure, place it on his own phonograph and listen to the message. This phonogram may be saved and it may be caused to reproduce the voice of the correspondent at any future time.

James Asher.

Dunnville, Ont., Canada,
March 3rd, 1899.

Slater Lewis v. The Scientific Publishing Company and John Heywood.

I am much surprised at the remarks which you made in your last week's Review anent this case. If you had merely given the judge's summing up in full I should have been perfectly satisfied, inasmuch as it clearly shows that I succeeded in gaining his Lordship's sympathy, and to have gained his sympathy to such an extent, that he asked the defendants if they intended to ask for costs—a most obvious remark—proves that I succeeded morally if not legally. However, I enclose a *verbatim* copy of Mr. Justice Cozens-Hardy's "summing up," in the hope that you will do me the justice of publishing it, in order to remove the effect which your remarks have undoubtedly created. I will only say, in conclusion, that the three hours' speech to which you sarcastically refer was almost wholly devoted to drawing the attention of his Lordship to the paragraphs which I had marked in my book, and cross-referenced and marked in the defendants' book, and which had, without question, been confiscated from my work. These paragraphs numbered no less than 109. Comment is needless, unless you mean to say that such wholesale piracy is justifiable. Perhaps you do!

John Slater Lewis.

"Norwood," Ellesmere Park, Eccles,
March 21st, 1899.

Mr. Justice Cozens-Hardy: In this case the plaintiff seeks an injunction restraining the defendants from infringing the copyright of a book called "The Commercial Organisation of Factories." I have had the advantage and the pleasure of listening to an exceedingly able explanation of this case by the plaintiff in person, and I think he has said everything that can possibly be said in support of his case. The plaintiff is the author of a valuable book called "The Commercial Organisation of Factories," on which he has expended a great deal of time and labour and money, and I should regret extremely if any word fell from me which could lead him or anyone in court to suppose that I thought his book was not most meritorious and most praise-

worthy. But in this case the only question is whether that book, the copyright of which is duly protected by registration, has been infringed by another book. I say book, because the articles in question have since been republished in book form and published by the defendants, under the title of "The Commercial Management of Engineering Works." Now, it is quite plain that any one of Her Majesty's subjects is at liberty to write a book on the commercial organisation of factories or the commercial management of engineering works. It is, I think, equally manifest that any two men seeking to write upon a subject of that kind must necessarily cover to a large extent the same ground, and I cannot help thinking that Mr. Lewis has rather got in his mind an idea that copyright is something which is intended to protect the ideas of an author from being either stated or multiplied or copied, if you like, by any subsequent author, when, in fact, copyright is merely a matter of form. I take it that if any man—if Mr. Lewis, for instance—has devised and suggested and notified to the public in his book that it is desirable to have a certain number of checks—I think four in number in this instance—of a particular shape for workmen at a particular time, it is perfectly open for any subsequent person dealing with that subject to say that it is a good thing to have four checks of different shapes to be used in that way, and he can do that without any infringement of copyright. Now I have carefully looked at and considered every one of the instances which Mr. Lewis has referred to in comparing the two books, and I do not think that any one of them taken alone, or all of them taken together, can be held to amount to that which in law is an infringement of the copyright of the plaintiff's book. It is not unlawful that the same words should be used to a considerable extent in describing and in dealing with the same subject. That has been done to a considerable extent by the defendants. But to quote the well-known test applied by Lord Eldon nearly 90 years ago to this case. Lord Eldon said that there is no piracy—that is, no infringement of copyright—if there is a legitimate use of a publication in the fair exercise of a mental operation deserving the character of an original work. I cannot doubt that the defendants' book does deserve the character of an original work within that meaning. Some use has admittedly been made of plaintiff's book. That use is not, in my view, beyond those limits which the law permits, and although I have great sympathy for the plaintiff, I am very sorry to be obliged to come to this conclusion, and can only come to the conclusion that he has failed, and that his action must be dismissed, and the costs will be the defendants' if they are asked for. Do you ask for costs, Mr. Astbury?

Mr. Astbury: If your Lordship pleases.

Mr. Justice Cozens-Hardy: Very well.

[Correspondence.—The crowded state of our columns compels us to hold over until next week a letter received from Mr. F. W. Cooke, of Retford, on "Railway Block Signalling."—Eds. Elec. Rev.]

PARLIAMENTARY COMMITTEES.

A Private Bills Committee of the House of Commons sat on Thursday last week to consider various Bills promoted by electric lighting and other companies. Sir. W. Coddington presided, and the other members were Mr. Clough, Mr. Price, and Mr. Cubitt.

St. James's and Pall Mall Electric Lighting Company.

Mr. Balfour Browne, Q.C., appeared with Lord Robert Cecil in support of the Bill of the St. James's and Pall Mall Electric Light Company. He said the Bill was to empower the St. James's and Pall Mall Company to acquire land and erect generating stations and for other purposes. It was an almost exactly similar Bill to that which passed through Parliament last year at the instance of the Chelsea Electric Supply Company. The company came into existence in the year 1888, and was registered, and proposed to raise capital to the extent of £100,000. For the first seven years it worked under a licence, but in 1890 it got a provisional order, by which it got a length of life of 42 years from August, 1889. The present capital was £160,000 ordinary shares and 100,000 preference shares, but at the start of the company it was very difficult to get capital. Their first station was at Mason's Yard, but subsequently another station was acquired at Carnaby Street, and now the Mason's Yard station was simply used at times when the pressure on Carnaby Street was too great to be met. There had been a steady increase in the number of the company's consumers, and if they were to do their duty by these consumers, they must extend their Carnaby Street station, and that was what they were there for that day. They must have more land, and they could not get the land by agreement, and therefore they asked for powers to compulsorily acquire land. There were two sets of petitioners complaining that their land was taken, and they could have cause. The only petitioner against the Bill who had no land taken was the Vestry. In 1890 the company had 177 customers; in 1891, 328; in 1892, 449; in 1893, 564; in 1894, 659; in 1896, 1,029; in 1897, 1,208; and in 1898, 1,394 customers. They had now 142,853 lamps on the circuit, and that number was constantly increasing. The units supplied in 1891 were 1,000,000, and in 1898 they were 3,448,000. They only had a surplus capacity of plant of 13 per cent. in the busiest portion of the day, and in the case of a fog or breakdown, that capacity might easily be exhausted. A prudent surplus capacity should be at least 25 per cent. They had not got a monopoly of supply in the district, for their competitors were the London Electric Supply Corporation. Owing, however, he hoped to good management, they supplied 90 per cent. of the parish. The charges they made were most moderate, for the average price per unit was 4⅝d., while for public lighting the charge was 2½d. per unit, which was lower than the Hampstead and Islington and other vestries who had their own works supplying the light. The total capacity at present in the station was 4,500 horse-power, and by the extension of the Carnaby station, which they were now applying for, they would increase that capacity by 2,500 H.P., which would be exhausted in 1901. At one end of the addition, however, they proposed to put up transformers, which would be used in connection with the generating station they were seeking to put up in conjunction with the Westminster Company on the banks of the Regent's Canal. They must bring all their electricity to Carnaby Street because all their mains radiate from that station. The Vestry petitioned against the Bill as custodians of the public thoroughfares, Marlborough Road and Carnaby Court proposed to be closed, and contended that considering their area of supply was confined to the parish there was no reason why they should seek to acquire such an extended station. The Vestry also complained that there was no provision made for the payment of any loss of rates the Vestry might incur from the time the existing tenements were pulled down till the new station was erected. That was a provision under the Land Clauses Act made to apply to railways, but there was no precedent for applying that provision to electric lighting works, and, in fact, the works would be proceeded with as rapidly as possible. The Craven Trustees petitioned on the grounds of the nuisance which would be caused and the depreciation which must be caused to their adjoining property. As a matter of fact, the land which it was stated would be injured was the very land which the company sought to acquire. The only other petition against the Bill was a firm of card and cardboard manufacturers whose premises were to be acquired. All the matters raised, however, by these petitioners would be matters of compensation.

Mr. Eustace Balfour, chairman of the company, and also chairman of the Central Electric Supply Company, was called, and described the difficulty the company had at first in raising capital. Now they paid 7 per cent. dividend. He bore out the opening remarks of counsel.

Mr. C. A. Russell, who represented the Craven Trustees, cross-examined witness with a view to showing that inasmuch as the station would only enable the company to meet the demands upon it for a few years, it would be better to concentrate all their efforts on the proposed station on the Regent's Canal.

Mr. Boyle, Q.C., representing Messrs. Halsey & Davidson, cardboard manufacturers, whose premises are sought to be acquired, asked witness if he would undertake to acquire the premises and give his clients 12 months' notice?

Witness said he could not answer such a question right off, but he would undertake to meet the firm in every possible way.

Mr. Berkley, who with Mr. Freeman, Q.C., represented the Vestry, asked witness if it was a fact that by 1901 the Carnaby Street station would become nothing but a transforming station, and that at the end of the 42 years' life of the company the local authority might find they had nothing left to purchase?

Witness said he could not say what would be the state of the station at the end of the 42 years.

Re-examined by Lord Robert Cecil: As far as it was possible they would generate electricity at Carnaby Street, as it was to their interest to do so.

By the Chairman: At present they charged 3d. per unit for electrical energy, and the reason they supplied it cheaply was because the demand for it was during the day. They hoped eventually to reduce the charge to 2d., and so compete immediately with gas.

Mr. S. Dobson, chief engineer of the company, described the steps which had been taken to prevent grit coming from the shafts and to prevent hot water getting into the sewers. He estimated that in 10 years they would be supplying 500,000 lamps. The motor industry at present was almost untouched. They had a number of small industries in the district to which they could supply current if they could reduce the price to 2d.

By Mr. Freeman: If the Central Supply Bill did not pass they would want a great deal more land adjoining the existing station. It was premature to discuss whether they could reduce the price for motor purposes to 2d. directly the contemplated extension was complete.

Replying to Mr. Russell, Witness said he did not think the London Electric Supply Corporation could supply them with the current they required.

Sir Frederick Bramwell said he was a director of the Kensington and Knightsbridge Electric Lighting Company, but was not connected with the Pall Mall Company. He had visited Carnaby Street station, and it was completely full of plant. There should be a reserve power of 25 per cent., and he would prefer 30 per cent. There was no vibration or noise susceptible at the station. He confirmed what had been said by the last witness with regard to the necessity of the extension of the station.

Prof. Kennedy said that he was afraid it would be more than two years from the passing of the Central Supply Bill before they would get any current from the central station. At present the St. James's Company was very cramped for coal storage and for workshops.

Mr. Robert Viger, who surveyed the property scheduled in the Bill, said it was impossible to obtain land for such a purpose by agreement. There was nothing on any of the properties affected which could not be met by ordinary compensation.

Mr. Freeman addressed the Committee for the Vestry, and suggested that it was impossible to separate the Bill from that for the central station which would follow. He admitted that the company had mitigated the nuisances complained of in the early days of the company, but there were still many complaints, and if the place was

enlarged the nuisance must be increased. The station was not far from Regent Street, and if there was nuisance, it would depreciate surrounding property. If they did not get the central station the whole of the enlarged Carnaby station would be devoted to generating. It was not a case in which public interest should be sacrificed for a mere trading company. The Vestry asked the Committee to say it was not a suitable site, and that the company could have acquired other stations had they chosen.

Mr. T. H. Mundsey, clerk to the Vestry, stated that the objection of the Vestry was to the displacement of inhabitants, the nuisance, and to any private company taking public roads for its own purpose.

At this stage the Committee adjourned till Friday.

The Committee, presided over by Sir W. Coddington, sat again on Friday to further consider the Bill.

Mr. Monson, the surveyor to the St. James's Vestry, was called by the petitioners against the Bill, and described the neighbourhood of Carnaby Street and the block to the traffic which occurred owing to the company's unloading operations. He considered the nuisance could not be obviated if the company acquired the scheduled property. If the Bill was accepted, he considered the company should widen Ganton Street.

Mr. Berkeley (for the Vestry) raised the question as to the houses scheduled by the company. It appeared that there are 17 separate houses, but two of them are let out in tenements. Counsel suggested that in reality the company would acquire 40 houses, inasmuch as two of the houses were let out in separate tenements. They did not wish to have to take expensive proceedings in another place to decide the question as to whether the company should be bound to re-house those people.

The Chairman asked if there was any precedent.

Mr. Berkeley said he believed that it had been decided by Committees that similar houses were tenement houses—each man having a key. He admitted that there was no reputed case.

Lord Robert Cecil, for the promoters, said his learned friend could not suggest that the company should have different terms imposed on it to anyone else. Their clause prohibited them from taking more than 20 houses, and it was a question for the Home Office to decide.

The Chairman: The company does not propose to re-house the 340 persons displaced?

Lord R. Cecil: We say that is a delusive figure.

Mr. Berkeley: But we have taken the number of people living there.

Lord R. Cecil: I am told that is the number of people who work on the premises.

The Chairman said they would not proceed further with that point at that stage.

Witness was further examined, and expressed the opinion that nuisance would arise from the enlarged station, and property would be depreciated. There would also be a great increase in the wear and tear of the streets caused by the company's building operations.

The Chairman: Has the rateable value of the property gone down in the neighbourhood since the electric light station was built?—I do not say that. I cannot contend that the rateable value has decreased at the present time, but I think it is likely to decrease.

Dr. James Evans, medical officer of health for the district, spoke of the grit nuisance at Mason's Yard as being detrimental to the health of the neighbourhood.

Other witnesses living in the neighbourhood were called to speak as to nuisance arising from vibration.

Mr. Russell, Q.C., then addressed the Committee on behalf of the Craven Trustees, who were the owners of the land proposed to be taken and the owners of land in the neighbourhood. He contended that the Committee were asked to decide on the Bill without having the essential points before them, because it could not be said how the scheme was carried out until the scheme of the central supply had been decided upon.

Mr. Goodwin, surveyor to the Craven Trustees, stated that the proposed extension of the station would injure the neighbourhood.

Mr. George Angold, a member of the Vestry and an owner of property in the neighbourhood, said he had lost tenants owing to the grit nuisance.

Lord R. Cecil: Has the rateable value been reduced?—In some cases it has gone down and in some cases gone up.

In further cross-examination, Witness admitted that he had asked the company to compensate him for the loss of a tenant, and the company refused.

Mr. J. Wallis, manufacturing tailor, living adjacent to the station, stated that owing to the smut and grit coming into the windows, they had to close the windows, as any light work was ruined. The nuisance had increased greatly in the past two years.

Mr. W. Watson, member of the Vestry, and formerly sanitary inspector of the parish, said many people had complained to him of the dirty condition of their rooms in consequence of the blacks from the Carnaby Street station. The complaints were increasing. At the quinquennial valuation in 1895 the rateable value of the houses in West Street was reduced.

A number of other witnesses were called by counsel for the Craven Trustees, including Sir John Whittaker Ellis, who stated that the erection of large factories always had the effect of driving residents from a locality, and he thought the extension of the company's existing station must necessarily depreciate the value of the property in the neighbourhood.

Mr. Boyle, Q.C., addressed the Committee on behalf of Messrs. Halsey & Davidson, whose premises occupied one-fifth of the scheduled site. The firm did not wish to be disturbed.

Mr. Balfour Browne replied for the company on the whole of the evidence, and said the company had been forced by the action of Parliament to have a generating station within the area of supply and there was no suggestion that they should give up their valuable plant and buildings they had acquired within the parish. Unless they got power to extend the station they would be unable to meet the public demand long before the proposed station on the side of Regent's Canal was erected. With regard to the displacement of people, they could not under the Act remove more than 20 houses without the consent of the Home Office. As to the stopping up of the two little streets, there had been no evidence of traffic at all. With regard to the Craven Trustees for Messrs. Halsey & Davidson, they could get compensation for any damage done.

The Committee having conferred in private, the Chairman announced that the preamble of the Bill was proved subject to the condition that Ganton Street, on which the property of the company abutted, should be widened. The Committee were of opinion that as the company proposed to take Marlborough Road, the Vestry was entitled to fair and proper compensation in the way of the widening of Ganton Street.

Mr. Balfour Browne said the proper course would be for them to bring up a clause. He had no hesitation in saying that with respect to the new property they would acquire abutting on Ganton Street, they would widen the road at once; but where the existing works abutted on the road it would be a serious matter.

The Chairman said that he and some of his colleagues had decided to go and look at the street and see what the structural difficulties were. It would not be fair on the part of the Committee to place impossible conditions on the company. At the same time, they were clearly of opinion that the authorities were entitled to some compensation. They also thought the greatest consideration should be shown to Messrs. Halsey & Davidson, and that the company should give them as long notice as possible.

Mr. Balfour Browne said he would pledge the company to give as long notice as they could. He suggested that in view of other electric lighting matters coming before the Committee, they might visit the whole of the works. He was told that if they threw part of the existing works into Ganton Street it would split up the boiler house.

The Chairman said they would leave the matter till Monday.

The Committee the adjourned.

On Monday, when the Committee resumed, Lord Robert Cecil, for the St. James's and Pall Mall Company, submitted the following clause to meet the finding of the Committee, that the company should give some compensation to the Vestry for acquiring a public street:—"Before stopping up Marlborough Road under the powers of the Act, the company shall set back the buildings on the south-east side of Ganton Street, between the eastern side of Marlborough Row and Marshall Street, to the line of their existing buildings on the south-east side of Ganton Street, and shall dedicate to the public as part of the street, the land lying between the new line of frontage and the existing street, and shall also pay to the Vestry the sum of £ as a contribution towards the cost of widening Ganton Street on the north-east side between West Street and Carnaby Street."

After some private consultation the final settlement of the terms of the clause was postponed.

Mr. Freeman, for the Vestry, sought to introduce a new clause to deal with the rehousing of the persons of the working class who would be displaced, but the Committee held that the Home Office had sufficient powers to deal with this.

On Tuesday the clause for effecting the widening of Ganton Street was agreed to by the Committee.

Wallasey Tramways and Improvements Bill.

Lord Poltimore presided over a Committee of the House of Lords which sat on Wednesday and Thursday last week to consider the Bill of the Wallasey District Council, which sought to empower the Council to extend the Wallasey tramways, which they proposed to acquire under statute, and to work by electricity, and to do various other things. The only petitioners against the tramway part of the scheme was the Wirral Railway.

Mr. Fitzgerald, for the promoters, said that under the Tramways Act of 1870 the local authority was entitled to purchase tramway undertakings at the completion of 21 years on favourable terms. The term would be completed in August, and the Council proposed exercising their powers, and to work the tramways by electricity, which they considered to be the most economical and convenient method. They proposed to construct a number of new lines in the district between Seacombe and New Brighton. The Wirral Railway Company complained that the proposed competition was unjust, because, under an agreement in 1893 with the local authority, the Committee decided that the railway company had no *locus standi*, except in regard to the proposal to carry the tramway over one of their bridges.

On Thursday it was intimated that the Council and the company had agreed upon certain clauses, but there was one upon which the decision of the Committee was necessary.

Mr. E. H. Lloyd (for the railway company) read the clause to the effect that any expenditure reasonably incurred by the Wirral Railway Company in protecting their electric signalling apparatus in consequence of the Council's electric tramway works should be paid by the Council, any dispute as to the amount to be settled by an arbitrator appointed by the Board of Trade.

Mr. Worsley Taylor, Q.C., for the District Council, objected to the clause on the ground that the Committee had confined a *locus standi* of the company to the street works on the bridge over the railway.

The Chairman said the Bill contained the form of clause recom-

mended by the Joint Committee of the two Houses, and therefore they had decided not to give the railway a *locus*.

The preamble was formally held to have been proved, and the Bill was ordered to be reported to the House.

Birkenhead Tramways.

A Committee of the House of Lords, presided over by Lord Poltimore, sat on Wednesday and Thursday last week to consider the Bill promoted by the Birkenhead Corporation for the construction of new tramways, &c. The chief opposition came from the Wirral Tramways Company, whose property it was proposed to acquire.

Mr. Fitzgerald, for the promoters, said the Corporation were prepared to offer terms to the company. They suggested they should purchase from the company their interest in the unexpired term of the lease of the line, and should acquire the tramways belonging to the company outside the borough, and the stables, coach-houses, and buildings attached thereto. In case of dispute, the amount of purchase money was to be settled by an arbitrator to be appointed by the Board of Trade; the purchase to be completed within 12 months of the passing of the Act. As the Corporation proposed to work the lines electrically they did not propose to purchase the horses. The company should work the lines till they received three months' notice from the Corporation for their own benefit, giving as good a service as at present.

Mr. Pope, Q.C., for the company, asked time to consider the proposal, and this was granted.

On Thursday it was reported that the scheme had been agreed to. The Committee went through the clauses, found the preamble proved, and ordered the Bill to be reported to the House of Lords as amended.

Central Electric Supply Bill.

The Select Committee, presided over by Sir W. Coddington, who considered the Bill of the St. James's and Pall Mall Electric Light Company on Monday, proceeded to consider the Central Electric Supply Bill.

Mr. Balfour Browne, Q.C., who, with Mr. Pember, Q.C., Mr. R. Wallace, Q.C., and Lord Robert Cecil, represented the promoters, stated that the object of the Bill was to confer on the Central Electrical Supply Company, Limited, power to construct works and supply electrical energy, and the intention of the promoters was to erect a new generating station in the parish of Marylebone, close to the Regent's Canal and the Central Railway. The matter had been frequently mentioned in connection with the St. James's and Pall Mall Electric Lighting Bill, and the Committee had heard that the capacity of that company's two stations was being rapidly exhausted. Consequently that company, with the Westminster Electric Supply Company, had been combining to erect this station outside their own areas of supply, and this was in accordance with the recommendations of the Joint Committee on Electrical Energy, which sat last session and inquired very fully into the subject. The Vestry of Marylebone would have the right to say what route should be followed by the company's mains, but the Vestry asked for power to purchase the works. It was not intended, however, to supply the Marylebone District from the works, and the proposal of the Vestry had not been contemplated by Parliament. If such power was given, the Vestry would be in a position to supply half London with electricity. The promoters were ready to supply electricity in bulk to a large number of authorities beyond Marylebone. The two companies guaranteed the necessary capital, and each would be entitled to a supply at cost price, so long as they took equal amounts.

Mr. Boulnois, M.P., a director of the Westminster Electric Supply Company, gave evidence in support of the proposal. He said that the Westminster Company found it impossible to get the new generating station they required in their own district.

The Committee heard further evidence in support of the Bill and adjourned.

On Tuesday the consideration of the Bill was continued.

Mr. Dobson, chief engineer to the St. James's and Pall Mall Electric Light Company, gave evidence in support of the Bill. He pointed out the great necessity for the company obtaining facilities for an increased supply of electricity, and expressed the view that the parish of Marylebone would be the gainers by having the station within its borders, inasmuch as it would increase the rateable value of the parish.

In reply to questions, Mr. Dobson said they had not yet settled whether the current to be generated should be a continuous or alternating current; but if the current was continuous, it would be at high voltage. The combined requirements for the two companies would amount to 18,000 horse-power, but authority was sought in the Bill to obtain between 40,000 to 45,000 horse-power. The wires of the promoters would cross the chief transmission main of the Metropolitan Electric Supply Company.

Sir Frederick Bramwell was called to show suitability of the site proposed, and Mr. Vigers, surveyor, gave evidence as to the necessity of the company having compulsory powers to get the land at a reasonable price.

Mr. Worsley Taylor addressed the Committee for the London County Council, and said that while the Council did not want to prevent companies extending the facilities they possessed for giving electric light to the public, yet they contended that powers to be given should be consistent with public policy, as that policy had been laid down in the statutes. In that case the promoters asked for compulsory powers without incurring a single obligation to the public. The Council objected to the promoters having the Bill without being under the ordinary obligations as to price, inspection, public safety, regulation of works, &c.

Mr. E. R. Moore, on behalf of the Metropolitan Electric Supply Company, said that his company generated electricity at Willesden, and carried their transmission mains through Marylebone and Paddington for the supply of those districts, and it was important that there should be no interference with their transmission mains.

Mr. Talbot, Q.C., having addressed the Committee for the Marylebone Vestry,

The Committee found the preamble of the Bill proved, and adjourned to consider the clauses the following day.

Charing Cross and Hampstead Railway.

This Bill came before a Select Committee of the House of Commons on Monday, presided over by Mr. Jeffreys. Mr. Worsley Taylor, Q.C., and Mr. W. Willis appeared for the promoters, while in opposition Mr. Freeman, Q.C., appeared for the London County Council, Mr. Lewis Coward for the Vestry of St. Martin's, Mr. Harold Russell for the Duke of Bedford, and Mr. Reginald Browne, Q.C., for Dr. Claremont.

Mr. Worsley Taylor said the object of the Bill was an extension of the line, for taking the necessary land, and the construction of the works, and the authorisation of the construction of three new railways, which would very greatly improve the scheme. For these purposes further capital powers were asked for. The need of communication between the railways in the north and those in the south of London had induced the promoters so to alter their original plan as to bring the proposed line in direct connection with the South-Eastern at Charing Cross, the North-Western at Euston, and the Midland at Kentish Town. The scheme had the support of the Midland, the North-Western, and the South-Eastern Companies. The new works would place Euston on the direct line and the proposed railway between Charing Cross and Hampstead, and give a connection with the Midland main line by a branch from Camden Town station to Kentish Town station. The total length of the line was 4½ miles. With respect to the petition of the County Council, asking for more favourable provisions as to workmen's trains, he considered the clause in the Bill providing for at least three workmen's trains each way before 7 a.m. and after 6 p.m. at penny fares, and the concession to the workman that he should be entitled to return by any train during the day, were a sufficient burden on the promoters. They were desirous, if possible, of meeting the County Council, and would consent to the insertion of a clause like that put into the City and Brixton Act last year, providing for at least 12 trains before 7 a.m. at a charge of not more than ½d. a mile, and that the company should not be bound to issue a ticket for a less sum than 1d., the passenger having the right to return by any train.

Mr. Freeman suggested a clause extending the hour to 8 o'clock in the morning, and a charge of 1½d. for the double journey.

After some further discussion, the matter was left over for arrangement. Later in the day a clause was agreed to, extending the time at which workmen's trains should arrive at the termini to 8 a.m., and fixing the fare at 1d. each way.

Mr. Alfred Willis, general manager of the South-Eastern and London and Chatham Railway Companies, considered this was the best electrical enterprise that had yet been promoted in London, giving, as it did, access to the northern lines from the South-Eastern, which latter company had agreed to give the Charing Cross, Euston and Hampstead Railway, very liberal rebates.

In reply to Mr. Coward, the Witness said the new railway would be 40 feet or 50 feet below the level of the ground, and it was proposed to bring passengers up from the underground station by means of lifts or a subway. There would be no difficulty about this, as the South-Eastern Railway owned the whole of the property on one side of Villiers Street and most of the property on the other side.

Mr. W. R. Galbraith, C.E., said the total expenditure on the proposed new works and lines would be £290,000. Cross-examined by Mr. Coward witness said that as the Charing Cross Road was a very wide thoroughfare there was no necessity to put the promoters under the obligation to set Cranbourne Street station back. He admitted that the proposed new levels would bring the line at Adelaide Street, Charing Cross, 13 feet nearer the surface than was authorised by the Act of 1893.

Mr. G. H. Turner, general manager of the Midland Railway, also gave evidence in support of the scheme as one which dealt with a difficulty at present confronting all railway managers, viz., that of dealing with local traffic in London, and of obtaining efficient communication between the termini of the great lines. Anything which could be brought forward with this object should be encouraged.

The Chairman said the Committee were of opinion that some undertaking should be given to set back the Cranbourne Street station, if necessary, and after some discussion the counsel for the promoters agreed that this matter should be left to the London County Council.

Mr. Harold Russell, for the Duke of Bedford, argued that his Grace was entitled to notice to treat in respect of the subsoil through which the proposed line would run under his property, and called evidence to show that this had been done in the case of the Central London Railway in respect of the Duke's property along Oxford Street and High Holborn.

Mr. Worsley Taylor objected on the ground that it would be creating a new principle, and said no such clauses had ever been inserted in a Bill. Nobody would put a penny into the enterprise if such clauses were inserted.

The Committee reserved its decision on this point, and declared the preamble proved.

The Central London Railway.

Mr. Jeffreys presided over a Committee of the House of Commons in Committee Room 13 on Monday to consider the opposed Bill of the Central London Railway; but on the Bill being called, it was announced that the opposition had been withdrawn, and the Bill was accordingly referred to the Examiner.

National Telephone Company's Bills.

On Monday the House of Lords Select Committee on Standing Orders had before it the National Telephone Company's Bills Nos. 1 and 2, the excusing of the non-compliances reported by the Examiner being opposed on behalf of several local authorities, on the grounds that the non-compliances were very serious, particularly in regard to setting aside the usual rights of local authorities. In all, 548 petitions have been deposited against the Bills in Parliament. The opposers asked the Committee not to allow the Bills to proceed, but the Committee decided to allow the Bills to proceed, subject to the omission of certain clauses.

Court of Referees.

The Court of Referees met on Thursday to hear objections to certain petitioners against the Edinburgh Corporation Bill, which sought power to provide, erect, and maintain a municipal hall for the city, to provide increased facilities in connection with the electric lighting undertaking of the Corporation, to construct works and tramways and other purposes. The petitioners objected to were not objecting to that part of the Bill which deals with electrical matters, and the Court granted a *locus standi* in two cases, and disallowed it in one case.

The Court heard an objection to the petition of Mr. Geo Coats, of Bellisle, against the Ayr Burgh Bill, which, amongst other purposes, seeks power to work municipal tramways by electricity. The petitioner alleged that his property would be injured by the proposed tramway, but a *locus standi* was disallowed on the ground that the petition was improperly drawn.

BUSINESS NOTICES, &c.

Auction Sale.—On Monday and Tuesday next Messrs. Shread & White will sell by auction at 57, Station Street, Birmingham, by order of the liquidator of the Reliable Art Metal Company, a large stock of art metal gas and electric light fittings.

Bankruptcy Proceedings.—A summary statement of the affairs of Frederick Marson, King Richard's Road, Leicester, has been issued by the Official Receiver, Mr. J. G. Burgess, in which is shown unsecured liabilities amounting to £478 5s. 8d., and assets estimated to produce £675 7s. 1d., leaving a surplus of £197 1s. 5d. Debtor attributes his failure to ill-health.

A receiving order was made on 16th inst. on debtor's own petition in the case of W. A. Charles and J. S. Blackwell (Central Electrical and Engineering Company, Church Gate, Leicester, and Kennington Road, London). The first meeting is arranged for March 28th, at 2.30 p.m. and the public examination for April 26th at 11 30 a.m. both at Bankruptcy Buildings.

Dissolutions, Liquidations, and other Notices.—On 25th inst. Mr. Justice Stirling will hear a petition for confirming a resolution reducing the capital of the St. James's and Pall Mall Electric Light Company from £300,100 to £300,000.

Creditors of Messrs. Veale & Co., Limited, are to send particulars of their debts, &c., and the usual information to the liquidator, Mr. J. M. Coon, St. Austell, Cornwall, by April 12th.

A meeting of the Edison Gower-Bell Telephone Company of Europe, Limited, is to be held at 186, Shaftesbury Avenue, W.C., on April 27th, at 3.15 p.m., for hearing an account of the winding up from the liquidator, Mr. R. Rodgers.

Bills in Parliament.—According to a report which has been prepared by the Board of Trade, the total number of Bills relating to railways, canals, tramways, and the supply of gas, electricity, and water, deposited in Parliament for the present session is 214, as compared with 197 for the session of 1898. The *Times* says that the Tramways Bills are 37 in number, involving a capital of £3,550,447. The Bills affecting gas supplies number only 31, with a proposed capital of £6,453,582; those connected with electricity are nine in number, with a proposed capital of £6,125,000. The suggested tramway extensions, 205 miles.

The Building Trades Exhibition.—This Exhibition, which opens at the Royal Agricultural Hall, Islington, on April 26th, and closes on May 6th, will have an electrical section arranged in the Minor Hall, and applications for the remaining space should be made at once to Mr. H. Greville Montgomery, the manager, at the Exhibition offices, 43, Essex Street, Strand. There will also be an exhibition of smoke abatement appliances, and for this section the committee of the newly formed Coal-Smoke Abatement Society is offering medals and certificates of merit.

Electrical Wares Exported.

Week ending Feb. 1st, 1898.

Port.	Value.
Adelaide	£37
Amsterdam	360
Bangkok. Teleg. mat.	71
Beira	1,355
Bombay	13
Boulogne	69
Brisbane. Teleg. poles	1,975
Buenos Ayres. Teleg. mat.	586
Cape Town	1,324
Calcutta	220
Channel Isles	25
Christiania	10
Colombo	199
Constantinople	1,070
Copenhagen	19
Delagoa Bay	83
Durban	469
East London	168
Flushing	19
Fremantle	771
Gibraltar	79
Gothenburg	15
Hamburg	78
Hong Kong	76
Lisbon	300
Ostend	85
Rio Janeiro	195
Rotterdam. Teleg. mat.	150
Shanghai	522
St. John's, N.B.	20
Stockholm	30
" Teleg. wire	179
Sydney	582
Wellington	106
" Teleg. mat.	292
Yokohama	3,978
Total	£15,260

Week ending Jan. 31st, 1899.

Port.	Value.
Adelaide. Teleph. apparatus	£1,270
Amsterdam	75
Antwerp. Electric fuses	225
Bilbao. Teleg. cable	282
Boca. Teleg. mat.	247
Bombay	265
Calcutta	87
Cape Town	257
Colombo	16
Delagoa Bay	144
Durban	595
East London	190
Ghent	82
Hamburg	180
Hiogo	134
Hong Kong	561
Marseilles. Teleg. mat.	765
Mauritius. Teleph. stores	94
Melbourne	212
Montreal	42
Port Said	135
" Teleg. mat.	69
Reval. Teleg. mat.	834
Rotterdam. Teleg. mat.	55
"	50
Sydney	718
Trieste. Teleg. mat.	500
Yokohama	389
" Elec. instruments	1,010
Total	£8,933

Foreign Goods Transhipped :—

Sydney. Teleph. wire	£123

Electrical Wares Exported.

Week ending Feb. 8th, 1898.

Port.	Value.
Albany	55
Alexandria. Teleg. mat.	205
" Teleg. cable	387
Amsterdam	107
" Teleg. mat.	13
Auckland	44
Bombay	97
" Teleg. mat.	21
Boulogne	188
Buenos Ayres	824
" Teleg pole	300
Calcutta	845
Cape Town	1,794
Charters Towers	120
Colombo	100
Durban	249
" Teleg. mat.	17
East London	868
Flushing	23
Gibraltar	60
Gothenburg	148
Hamburg	276
Malaga	210
Melbourne	610
Naples	13
Port Elizabeth	119
" Teleg. mat.	267
Rotterdam. Teleg. mat.	110
Shanghai	33
Stockholm	1,850
Sydney	370
Trinidad	27
Wellington	26
Total	£9,496

Week ending Feb. 7th, 1899.

Port.	Value.
Adelaide	£189
Alexandria. Telep. mat.	12
Amsterdam	205
Auckland	91
Bombay	74
Boulogne	98
Buenos Ayres. Elec. lighting ap.	1,638
" Teleg. mat.	120
Calcutta	2,990
Cape Town	849
Delagoa Bay	185
Demerara	21
Durban	75
East London	23
Ghent	90
Hamburg. Teleg. mat.	800
Launceston	33
Lisbon	50
Madras	473
Melbourne	79
Napier, N.Z.	30
Port Elizabeth	656
Port Said	20
Rangoon	50
Rotterdam. Teleg. cable.	87
Shanghai	134
" Teleg. cable	1,880
" Telep. mat.	25
Singapore	15
" Teleg. cable	10,500
Sydney	1,225
" Electric light cable	186
Syra. Teleg. mat.	17
Wellington, N.Z.	299
" Telep. mat.	1,714
Total	£24,374

The B.T.H. Company.—The following are particulars of orders which have been recently booked by the British Thomson-Houston Company, Limited :—

Leeds—Extensions to overhead line construction for the city tramways. *Glasgow.*—Two direct-connected 1 100 H.P. lighting sets (Belliss engines), for the Corporation Electricity Department. *Govan.*—Two 93-kw. generators and Belliss engines, three-machine booster, and two-machine booster, for the Burgh of Govan electric lighting. *Sheffield.*—Two 500-kw. extension generators for the Corporation tramways. *Croydon.*—One 500-kw. 2,100-volt direct-connected alternator and Belliss engine for the Corporation electricity works. *Sheffield*—Two 325-kw. direct-connected generators and Belliss engines, with switchboard, for Messrs. Vickers, Sons and Maxim, Limited, River Don Works, Sheffield. *Dudley and Stourbridge.*—Nine double motor equipments for the Dudley and Stourbridge electric tramways (through the British Electric Traction Company, Limited). *Lowestoft.*—One 150-kw., one 75-kw. generators, and four-machine booster balancer, for the Corporation (through Messrs. John Musgrave & Sons). *Manchester.*—Three car trucks with double motor equipments, with magnetic brakes, for the Corporation tramways. *Colombo.*—Six double motor equipments with magnetic brakes, being an extension of the present tramway plant. *Potteries, extension.*—Two 220-kw. generators direct-connected to horizontal tandem compound Ball & Wood engines for proposed Wolstanton power station.

Burns v. Mason & Co.—Before Mr. Justice Grantham and a special jury the other day plaintiff, of Long Lane, Aldersgate Street, sought to recover from defendants, who were builders and contractors, damages for injury alleged to have been done to a large quantity of fibre sheeting by defendants leaving a tap running on one of the upper floors. The water was declared to have found its way down to the basement and rendered the stock completely useless. Defendants declared that the claim was a fraudulent one. In the course of a lengthy hearing Mr. Crawley, an electrical engineer who had inspected the goods, said in evidence that it was in his opinion an absolute impossibility for the damage to have been caused by the overflow. He had also tested the fibre after being soaked in water and then dried for electrical purposes, and found it better than it was previously. The jury found a verdict for the plaintiff for £50.

Catalogues, Lists, &c.—Messrs. Davis & Timmins have brought out an excellently arranged and neatly printed set of sheets, collected in catalogue form, in which illustrations, sizes and prices of their manufactures in the way of screws, clamps, terminals, &c., for electrical work, bolts, nuts, studs, &c, are included. The firm is proceeding to increase its output by equipping a further large factory with automatic machinery, &c., of the latest types.

Messrs. Isenthal, Potzler & Co., of Mortimer Street, W., have issued a list of apparatus and accessories for Röntgen ray outfits. The firm keeps a large stock and a well-equipped laboratory.

The Pacific Electric Company, of La Crosse, Wis., send us lists of their "Epersen" shade lamps, and the dental and surgical lamp.

The Langdon-Davies Electric Motor Company are circulating lists giving terms of hire and hire-purchase of their alternate current motors, also a telegraphic code for ordering motors of various B.H.P.'s, voltages, and periodicities.

Change of Address.—The offices of the *Machinery Market* have been removed from 171, Queen Victoria Street, E.C., to Wardrobe Chambers, 146a, Queen Victoria Street, E.C.

County of London and Brush Provincial Bill.—The London County Council and the Vestry of St. George-the-Martyr, Southwark, have deposited petitions praying to be heard against the Bill promoted by the County of London and Brush Provincial Electric Lighting Company, Limited, for powers to erect generating stations outside their area of supply. It is alleged by these public authorities that this proposal is intended to be an evasion of the Electric Lighting Act, 1888, which gives to local authorities power to purchase the undertaking within their respective districts. It is contended that if the company are allowed to erect generating stations outside their area of supply, the local authorities could not purchase a complete system for supplying electricity, inasmuch as they would only acquire the mains within their districts, without the means of generating electricity. It is therefore suggested, says a financial contemporary, that if the Bill be allowed to pass, provisions should be inserted to obviate, so far as practicable, the difficulties which will arise as to purchase by local authorities by empowering the London County Council, as the central authority, to purchase the works authorised by this Bill at the expiration of 42 years from August 26th, 1889, which is the date upon which the concessions granted to most of the existing companies will expire. In the event of the works not being then purchased, Parliament is asked to place the company under obligations not to raise its charges to local authorities who may be dependent upon the company for supply.

Insulation Recording Apparatus.—A new recording arrangement has been patented by M. Travailleur and introduced by Messrs. Elliott Bros. as an accessory to their recording instruments. It is an apparatus for continually recording insulation of two or three-wire systems under actual working conditions. The recording instruments consist of a voltmeter of high resistance, one pole of which is connected to earth, and the other pole is connected to any one of the three wires of a three-wire system, assuming that neither of the three wires is permanently connected to the earth. At regular intervals of one hour a shunt is connected across the moving coil of the recording voltmeter, and therefore the position of the recording pen is changed upon the chart; the indication naturally being a smaller one than before the shunt was applied. By suitably choosing the value of this resistance in accordance with the special requirements of particular cases, and by measuring the change in the indication, the insulation resistance of the wire or main to which the instrument is connected, can then be worked out by a simple formula, by knowing the electrical pressure, the resistance of the instrument coil, and the resistance of the shunt. A continuous watch can therefore be kept upon the insulation of any feeder, and changes in this insulation can be observed from time to time, and steps can be taken at any convenient moment to remedy any defects.

Is Electricity an Article?—An interesting point was decided at Bilston Police Court on Tuesday, when the stipendiary magistrate (Mr. N. C. A. Neville) gave judgment in the recent prosecution undertaken by the factory inspector (Mr. Jackson) against the Bilston Urban District Council for a breach of the Act at the Market Hall by not posting up a copy of the abstract. The case had been fully gone into when the prosecution argued that the Market Hall was a factory, inasmuch as electricity was an article manufactured by way of trade, and for the purpose of gain. The contention of the defence was that electricity was not an article, and that it was not manufactured for the purposes alleged.—The Stipendiary, in giving judgment, said the dictionary interpretation of the word "article" was "commodity," and a commodity was that which was useful or advantageous. Electricity being made at the works required mechanical power, manual labour being also exercised. It would come within the meaning of the Factory and Workshops' Act if it was an article which he thought it was, and if it was used for the purpose of gain. The object of the Act was to enclose everything it possibly could under its provisions. It would not do at all to confine the interpretation of the word "article" if there was anything similar to any other manufactured article. Electricity was similar to many other things; it could be manufactured, stored, moved about, converted into different uses and stolen, and those things were things applying to a good many other articles. The Council gained the benefit of the light in the market, and it must be said to be a gain within the meaning of the Act. The magistrate imposed the nominal penalty of 2s. 6d. and costs (£1 17s. 6d.).

Melbourne Working Men's College.—We have received from Melbourne a copy of the 1899 prospectus of the above college containing particulars of rules, classes, courses, and illustrations of the different departments.

Removals.—Mr. C. A. Clarke (of the International Electric Company) notifies his removal to 26, Seymour Road, Crumpsall, Manchester.

Messrs. Entwistle & Stephens, manufacturers of electric lamp shades, have just removed from 10, Gray's Inn Road to Baldwin's Gardens, Gray's Inn Road, W.C. The showrooms at 12, Farringdon Avenue, E.C., will be retained.

Theatre Lighting.—With further reference to the statement regarding the lighting of the Lyric Theatre, Mr. A. Keerber, of Shaftesbury Avenue, writes to further correct this. He says that the Lyric was wired completely, that is, the stage, auditorium, engine room, accumulator room, and also a complete set of residential chambers adjoining the theatre, at the time of erection, by himself. The two gas engines were of the Stockport type of 20 H.P. each; the two dynamos being by Statter; and the accumulators E.P.S. type. This plant has since been removed, and the theatre is now lighted partly by gas, and partly by current supplied from the street mains.

Trade Announcements.—Owing to the rapid increase of business in the Leeds district, Messrs. Laing, Wharton & Down, Limited, have decided to appoint Mr. Douglas J. Callow (until recently engineer to the Brewster Engineering and the Reedy Elevator Companies of New York), as their district manager and representative. Mr. Callow has had considerable experience in electrical contracting work of all kinds both in this country and in America. M. C. T. Taylor remains on the firm's staff as assistant engineer.

Messrs. Wm. Whitehouse & Co., gas and electric light fittings manufacturers, of Birmingham, have appointed Mr. C. Pfeiffer to represent them in London. Mr. H. C. Harold no longer represents the firm.

In consequence of increased business, Messrs. Williamson and Joseph have appointed Mr. John G. Dixon, of 55, Norfolk Chambers, Norfolk Street, Sheffield, to represent the company's interests. Mr. Dixon will cover the whole of the North of England from Derby. The firm have also appointed Messrs. Ross & Co., of 95, Bath Street, Glasgow, as agents for Scotland, and Mr. A. F. Sargeant, of 51, Lincoln's Inn, Corporation Street, Birmingham, will represent the company's interests in Birmingham and surrounding district.

The Unbreakable Pulley and Mill Gearing Company, Limited, have appointed as sole agent for Rochdale and district, Mr. J. J. Smithies, Atlas Works, Baron Street and Livsey Street, Rochdale.

W. T. Glover, Limited v. William James Glover and Co. (established 1818), Limited.—On Monday, at Manchester, before Vice-Chancellor Hall, Q.C., Mr. Maberly applied for leave to serve notice of motion for Monday next in this case, in which the plaintiffs seek an injunction to restrain the defendants from carrying on business as makers of electric cables, &c., under any title of which "Glover" forms a part. The Vice-Chancellor granted the application.

ELECTRIC LIGHTING NOTES.

Alva.—At the last meeting of the Burgh Commissioners it was stated that a gentleman had been in the field with regard to an installation of electricity for Alva and Tillicoultry. From various remarks made, it would seem that the idea will meet with opposition.

Anglesey.—The proposal to light the North Wales Lunatic Asylum by electricity at a cost of about £4,442 was before the Anglesey County Council last week, and was referred to the Visitors for observations.

Asylum Lighting.—The Devon County Council has voted £250 for an electric light plant for the County Asylum.

Bangor.—The Town Council have resolved that the town clerk be instructed to obtain possession of the electric lighting guarantee bond, and to retain possession of it pending further instructions. A resolution that the guarantors should abstain from taking part in the Council work was negatived on a division.

Bradford.—The half-yearly statement of the Gas and Electricity Committee, which was last week adopted by the City Council, shows that the electricity undertaking for the last half-year produced a total income of £13,011, an increase of £2,169 over the corresponding period of last year. The total expenditure, including interest and sinking, had been £10,519 10s. 3½d., an increase of

£2,577. The profit for the half-year had been £2,491, a decrease of £407. The number of consumers was 850, an increase of 31 per cent., and the total units consumed, exclusive of current for trams, &c., had been 723,000, an increase of 31 per cent. The total profit since the opening of the works, after paying interest and sinking fund, was £20,882, the total taken off for depreciation £10,556 12s. 3d., leaving £10,326 to be appropriated as the Council thought fit.

Bridge of Allan.—Edmundsons' Electricity Corporation desire to light the village, together with Dunblane. The Police Commission have remitted the offer to the Lighting Committee to report.

Brighton.—The proposals of the Electric Light Committee set forth in the Review last week have been adopted by the Town Council. During 1898 22,248 new private lamps were connected to the mains, making a total of 108,457 lamps.

Bristol.—At the end of last year the Corporation had 919 private consumers, representing 63,079 lamps, whilst at the end of last month the figures had gone up to 959 consumers and 67,144 lamps, and there were nine more consumers, representing 1,543 lamps in the process of being connected. The whole of the arc lighting in the streets is complete, and is working most satisfactorily. The fitting up of the new 400 kilowatt alternators is progressing smoothly.

Carnarvon.—The Town Council have refused to grant permission to Messrs. Lake & Co., a local firm of general merchants, to cut up the roads in the town for the purpose of laying down electric wires.

An electricity installation for the Asylum would cost £4,542. The matter was before the County Council last week.

Chester.—Last week the Council adopted various recommendations from the Electric Lighting Committee for the extension of mains for public and private lighting in a number of streets, the total cost of the various works coming out at £2,625.

Chesterfield.—The Electrical Energy Committee last month considered letters received from Messrs. Siemens and the Westinghouse Company, with reference to the provision of plant for an electrical installation, and it was resolved that the Westinghouse be asked to make an inspection of the borough and submit a report and estimate of the cost of a scheme for public and private lighting.

Colne.—The Town Council has appointed a special Committee to inquire into the whole question of electricity supply, traction, &c.

Colwyn Bay.—The Works' Committee reports an interview with Mr. Clirehugh, electrical engineer, as to the scheme to be adopted, and the substitution of a steam engine for a gas engine. The committee recommended that the Council apply for a loan of £4,000 to carry out the scheme. Mr. T. Parry moved the adoption of the report. The advantage of adopting Mr. Clirehugh's suggestions would be that electric lighting could be easily extended to Rhos and Old Colwyn. The report was adopted.

Darfield.—On the 14th inst. Major Cardew held an inquiry on behalf of the Board of Trade into the District Council's application for a provisional order. Mr. William Johnson, of the Sheffield electricity undertaking, said that he estimated the cost of a scheme for lighting Darfield at from £8,000 to £10,000. He calculated that 121 16-C.P. lamps would be required for street lighting, these consuming in the year 33,067 units, which, at the suggested cost of 4d., gave an annual total of £476. This would leave a balance of 73,388 units for private lighting at an average of 4d. per unit. The cost of the electric street lighting would be only £4 7s. 6d. per lamp per annum, against £5 7s. for gas at 3s. 6d. per 1,000. Considerable evidence was given in opposition to the order, and the inquiry closed.

Dawlish.—The offer of a firm of electrical engineers (Messrs. Taylor & Field) to interview the Council in regard to electric lighting has been accepted.

Denbigh.—The estimated cost of the proposed electrical work at Denbigh Asylum is totalled at £4,442. According to a report presented by the Visiting Committee the introduction of electricity into the temporary building has been satisfactory.

Devonport.—Although it has not been actually rejected, there is faint prospect of Devonport adopting the suggestion that it should come to terms with the Corporation of Plymouth for the supply of electricity in bulk. The difficulties of obtaining a suitable site for the erection of an electric power station have not decreased. However, the Corporation has decided to appoint a resident electrical engineer.

Dewsbury.—The engine house of the electricity works is to be extended, and a new generating set installed. It is stated that the cables are at present heavily overloaded. An extension of mains to Oxford Road district is now completed, and current has been supplied.

Dorking.—Mr. Trentham's report on electric lighting is in the hands of Councillors, and the General Purposes Committee will consider it.

Dublin.—It is stated that the Municipal Industries Syndicate's offer to the Corporation in connection with its electricity undertaking embodies a proposal to spend £380,000 in providing electric light for the city; pay the Corporation £90,000 for their plant; keep about 1,000 men constantly employed; and reduce the price of lighting to the citizens by 30 per cent. Mr. W. C. Sax appeared before a public meeting on 14th inst. to explain the proposals on behalf of the syndicate. The Trades Council is asking the Town Council to seriously consider the offer.

Exeter.—Exeter has every reason to be satisfied with the success of the electric lighting undertaking since it came under municipal control. A business which was a very modified success under the old company has developed so considerably since it came into possession of the Corporation, backed with plenty of capital, that it has now quite outgrown its old clothes. A new generating station is an absolute necessity. Mr. H. D. Munro, the electrical engineer, reported to his committee the other day that the present station is now almost completely filled with machinery, and yet the cry is still for more current. Extension on the present site is impossible and perhaps undesirable, for it is by no means an ideal position. The Corporation are, however, reluctant to incur the expense of rebuilding in a more favourable position until the necessity becomes absolute. Next season is to be tided over by the erection of a new Babcock and Wilcox boiler of 500-H.P. capacity and a 250 kilowatt Ferranti alternator. Space for the boiler will be found on land leased from the London and South-Western Railway Company, and room for the alternator will be made by shortening the rope drive of the present day load machine. This will overcome the immediate difficulty.

Farnborough.—Last week the District Council finally decided, by six votes to five, to transfer (for 25 years) their electric lighting powers to Power and Traction, Limited, the promoters of the proposed light railway.

Fulham.—The Vestry has placed a contract with Mr. F. G. Minter to erect an electric generating station at £22,970, to be completed in 10 months. The Horsfall Furnace Syndicate, who are contractors for the erection of dust destructors, have received the sanction of the Vestry to the sub-letting of the chimney shaft contract.

Glasgow.—The Corporation has decided to write to the Partick Commissioners in regard to the proposed agreement for the electric lighting of Partick. The Partick people do not see their way to agree to the Glasgow Council's clauses. They threatened to carry out their powers without the assistance of Glasgow. Glasgow has since decided that it will not alter its terms.

The Corporation has approved of the Committee's proposal to pay £37,000 for the undertaking of the Kelvinside Electricity Company.

Ilfracombe.—Last week the District Council had before them a report on electric lighting from Mr. Trentham, but the members thought it better to defer any decision until after the District Council election, which will take place shortly.

Islington.—The Vestry considered at the last meeting a report by the Parliamentary Committee relating to the application of the Vestry of St. Pancras for permission to lay mains in York Road and Brecknock Road, Islington. It was resolved to inform the St. Pancras Vestry that as the latter have no power to lay mains outside their statutory area, the Islington Vestry have no power to grant them permission to do so. At the same time it was decided to remind the St. Pancras authority that an opportunity may be afforded by the London Government Bill for the re-adjustment of the boundaries of the two parishes, in which case the Vestry would be willing to assist in overcoming that and similar difficulties.

Italy.—A water-power driven central station has just been completed and put in operation in the Toscolano Valley by the Società Elettrica di Salo. The present plant, which is to be extended as requirements demand, consists of two triphase dynamos actuated by Pelton wheels, supplied by Messrs. Riva & Monneret, of Milan. The plant, which has a capacity of about 680 H.P., is supplying current for lighting purposes at Toscolano, Salo, Maderno and Desenzano. The central electric lighting stations of the Società Anglo-Romano per l'Illuminazione di Roma last year supplied 14,394,844 hectowatts of current for lighting purposes and 12,734,559 hectowatt-hours for power purposes; an increase of 741,643 and 2,680,154 respectively over 1897.

Kendal.—It is stated that the question of a public electricity supply undertaking is likely to be re-opened shortly.

Kettering.—The Electric Lighting Committee has received a letter from Messrs. Mackey & Co. offering to purchase their provisional order. The Committee will not deal with the question at present.

Leatherhead.—The District Council has been considering the electric lighting question in connection with the report prepared by Messrs. Hancock & Dykes. It has, however, decided to allow the Gas Company to put up 10 incandescent lamps, and has deferred further consideration of the electric lighting matter for six weeks.

Leicester.—At last week's Council meeting Alderman Lennard, in moving the adoption of the financial statement relating to the electric lighting department, said the total revenue for the half-year was £5,330, as against £3,654 in the corresponding half of the year, an increase of £1,676. With regard to a statement that had been made that the undertaking was a failure, he said that the installation was worth £100,000 more than it cost them, if they wished to sell it; but they would keep it and it would become more valuable to them every year.

Leamington.—On Tuesday Major Cardew held a Board of Trade inquiry touching the applications of the Leamington Corporation and the Midland Electric Lighting Company for provisional orders to supply electricity to the borough. Mr. Russell, Q.C., who represented the Corporation, said that the issue which would have to be reported upon was whether the future of electric lighting in Leamington was to be in the hands of the municipal authority or was to be left in those of the company who were doing such electric lighting as was now done in the town. He then sketched the history of the Corporation's relations with the Midland Electric Lighting Company, commencing in 1886. He submitted that the very last thing that the company now really wanted was a provisional order. They had begun the supply of electricity merely under an agreement with the Corporation, and they would never have applied, under any circumstances, for an order if they had not been driven to it. He contended that what the company wanted was their perpetual and unlimited rights and privileges, and as they did not really and honestly want a provisional order, let the Board of Trade gratify them by not giving it to them, and giving it to the Corporation, who did honestly and genuinely want it. After considerable evidence had been given, Mr. Hammond, consulting engineer to the Corporation, said it would be putting on the Corporation too onerous a burden in paying for the material at the price which was exhibited by the present capital of the company. He considered the clause proposed by the Corporation, to take over practically that portion of the plant which would be serviceable to them, was an extremely equitable clause, and one which should be satisfactory. No one pretended that the installation was a modern one. It would be an injustice to ask the Corporation to take it over at the cost price. He thought that with modern plant they would be able to supply electricity in Leamington cheaper than the company were now supplying it. This was the case for the Corporation. Mr. Macmorran, Q.C., said the company took up the matter of the electric light in Leamington in 1886 or 1887, when electric lighting was in its infancy. It was not until 1897 that they obtained a small dividend, and they felt that just at the time when there was a likelihood of their getting back some return for the money expended, it was little more than hard, it was unjust, to seek to deprive them of their undertaking, and that at a ruinous sacrifice, even if the suggested Board of Trade claure was accepted. It was on the faith of the dealings of the Corporation that the money was spent. The case required exceptional treatment. The application of the Corporation was to get rid of the agreement with the company. It was true the original intention of Mr. Arthur Chamberlain was to obtain a provisional order, but he delayed it, and then when he applied in 1890, the Corporation came in and opposed him, and the complaint of the Corporation was in reference to street lighting. It was unjust in every way to seek to deprive the company of the opportunity of getting back some return for their money. If the agreement with the Corporation was *ultra vires* in the first instance, then the moral obligation was all the greater, and the company had the more need for the protection of the Board of Trade. The inquiry was adjourned.

Leith.—Owing to increased demand for current the charge for power has been reduced from 3d. per unit to 1½d. For lighting current a scale of discounts has been drawn up by the Electric Lighting Committee. The Committee is disposed to supply current to the Dock Commission for lighting the Docks at 1½d. on certain conditions.

Lincoln.—The Local Government Board has sanctioned the Corporation's proposed loan for £19,000 for additional electric light plant.

Llanrwst.—It is stated that the electric light is to be switched on by Lord Carrington on the 29th inst., and a demonstration to celebrate the event is being arranged.

London.—The St. George's (Hanover Square) Vestry has had before it a letter from the Westminster Electric Supply Corporation, calling attention to the fact that the Marylebone Vestry were applying during the present session of Parliament for powers to supply electric energy not only within the limits of their own parish, but in a portion of that of St. George's, Hanover Square, and as there were already two companies supplying the parish, the corporation felt called upon to oppose the Bill. The Vestry will take no action thereon at present.

Middlesbrough.—A Local Government Board inquiry was held on 15th inst. into the Corporation's application for power to borrow £36,000 for electric lighting purposes. Mr. Hammond, consulting engineer, was present and explained the scheme.

Mile End.—The Guardians' Workhouse Committee proposed to appoint a competent engineer to take charge of the electrical arrangements at their various institutions.

Monmouth.—At the last meeting of the Corporation, the Mayor said that up to January 2nd last £9,546 14s. was placed to the electric lighting account, and he afterwards added that they had already exceeded the original contract by £2,500, and there was still more to come. One speaker thought the time had come when attention should be called to the excess over the estimate.

Montrose.—Messrs. Edmundsons' have secured a site for electricity works.

Portsmouth.—The Electric Lighting Committee has resolved to provide £3,600 for public lighting in the new estimate. The committee has accepted Messrs. Fraser & White's tender for coal at 11s. 9d. per ton. Twelve transformers are to be obtained at a cost not exceeding £80 each.

Ramsgate.—The Corporation are again considering the electric lighting question, and Mr. Valon, the engineer, has received instructions to submit a report, possibly in conjunction with some electrical expert.

St. Pancras.—The Vestry at the last meeting resolved, in the case of future appointments to the office of engineer in charge of the King's Road station, to fix the salary at £200 per annum, increasing by annual increments of £20 to a maximum of £300 without residence. In accordance with this decision, it was determined to increase in May next the salary of Mr. P. N. Hooper, the present engineer in charge, from £200 to £220 per annum.

Southampton.—On Thursday night last week the public inauguration of the street electric lighting took place. The Mayor switched on the current. Alderman Bore, deputy-chairman of the Electric Lighting Committee, in a speech welcoming the Mayor and the Works Committee, said that they had asked the Works Committee there that night in order that they might take over a portion of the public street lighting. He traced the history of the electric lighting undertaking from the time when the Corporation assumed control in 1896. Great advance had been made. In 1897, the first year they had possession of the works, they had 8,948 lamps connected, and at the present time they had no less than 23,000. The units supplied in 1897 were 131,000, and in 1898 they numbered 265,000, which showed that they had made very good progress. They had been some time in getting the street lighting ready, but they all knew the difficulties the contractors had had to contend with. They had now completed the first section of the work, and they looked forward to the Works Committee and the Tramways Committee being good customers of the electric works. They did not want to make a large profit, but each Committee must stand on its own bottom, and must pay for what it had from another Committee at a fair and reasonable price, and he was sure they would work amicably together. They had made provision for supplying the current to the tramways, and had ample plant for carrying out their present tramway system, and for a small extension as well, and when they had their battery room built, he hoped they would be in a position to supply more. They had made provision for a 100 street lamps, and that night they were lighting the first section only, but it would not be long before the other sections were ready.

Stirling.—The Police Commission has received a letter from the Secretary for Scotland approving of the borrowing of £25,000 for electric lighting. Lord Balfour wrote that he should be prepared to consider the question of increasing the amount to £30,000 at a later date on further application being made to him by the Burgh Commissioners.

Surbiton.—The General Purposes Committee is still considering the questions of the proposed tramways and electric lighting.

Swansea.—The Electric Committee has passed certain amendments in the plans for the electric lighting scheme, the total cost of which is stated at £24,648.

Teddington.—The District Council will on April 10th consider a proposal to apply for a provisional order for electric lighting.

Torquay.—The deficit on the first year's working of the electricity undertaking will not exceed £300. A credit balance is anticipated this year.

Ventnor.—A correspondent says that satisfactory progress is being made with the electric light works. The two engines have been tried, and it is hoped that everything will be ready for lighting on Easter Eve.

Wakefield.—At the last Council's meeting Alderman Sherwood, the chairman of the Electric Lighting Committee, reported that the revenue for the past year had been £2,318, and the total cost £1,135, leaving a gross profit of £1,183, or, after deducting £1,054 for interest and sinking fund, a net profit of £129 for the first year. He believed Wakefield was the first Corporation which had made a profit on its electric light scheme in the first year. He also mentioned that the total cost per unit of the electric light had been 2d. and 63 parts of a penny.

West Ham.—It will be remembered that the Town Council has been in correspondence with Messrs. Ferranti with regard to the rate of wages, &c., paid by them. Messrs. Ferranti have futher written stating that their tender had been prepared on the assumption that the conditions would be identical with those of the contract previously made with them, and that by requiring the Manchester rates to be paid, an entirely new point had been raised which they were unable to accept, and they had no alternative but to withdraw their tender and leave the Council to adopt such course as they thought fit. Having considered the subject and heard the remarks of the electrical engineer thereon, the Committee recommended that the electrical engineer be instructed to prepare specifications for the necessary engines and alternators, and that advertisements be issued inviting tenders therefor.

Whitechapel.—The District Board has briefed counsel to oppose the County of London and Brush Company's Bill.

Wimbledon.—Acting upon the Electric Light Committee's recommendation, the Council has resolved to charge 4d. per unit for places of public worship. The charge for public lighting will be £3 per lamp per annum. Tenders are to be obtained for wiring the electric light station. There are already 5,000 lights ordered.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Brompton and Piccadilly Railway.—The St. James's (Westminster) Vestry have resolved to withdraw their petition against the Bill.

Coatbridge and Airdrie.—The British Electric Traction Company have been for a long time past endeavouring to get their light electric railway scheme through. We now learn that the Coatbridge Council has resolved to approach the Airdrie Council as to combined operations to secure municipal tramways for both boroughs.

Colwyn Bay-Llandudno.—The provisional order for constructing a light railway between Colwyn Bay and Llandudno has been approved by the Board of Trade. It is stated that the project has been trying to get on to its legs for the past 10 years and has at last succeeded.

Dublin.—The Electrical Construction Committee last week considered plans submitted by the Dublin United Tramways Company for a new line running from Capel Street *viâ* Great Britain Street to Summerhill, and also new connections between existing lines to be constructed from Stephen's Green through Leeson Street and Baggot Street. These lines had previously been sanctioned, and the plans were now ratified. In most of the cases bracket poles will be used for electric traction, but where the thoroughfares are very wide centre poles will be erected.

Glasgow.—Last week the Corporation passed the minutes of both the Tramways and Electricity Committees, whose recommendations were referred to in the last issue of the Electrical Review.

Hamilton.—The Police Commissioners last week considered the Hamilton, Motherwell and Wishaw Light Railway scheme. It was declared that the line was a tramway and not a light railway, and should have been promoted under the Tramways Act. Various other objections were raised, and the commissioners decided to insist on the adoption of standard gauge for railways, and to ask power to use the tramway standards for street lighting.

Houghton.—It is stated that the Houghton-le-Spring Urban District Council have decided to support the company that is about to seek for powers to run an electric tramway.

Kirkcaldy.—The North British Railway Company has withdrawn its opposition to the Electric Lighting and Tramway Bill now before Parliament, so that it will now be considered as an unopposed measure.

Light Railways.—The Board of Trade has recently confirmed the Liverpool and Prescot Light Railway order, 1898, for the construction of a light railway in the county of Lancaster, from Liverpool to Prescot.

London.—The Highways Committee of the London County Council have under consideration a proposal to make an experiment as soon as possible with some system of mechanical traction on the tramways between Westminster Bridge and Tooting. A sub-committee has been appointed to further the project, and as the consent of the road authorities is necessary before application is made to the Board of Trade for a license, the Council have invited the Lambeth Vestry and the Wandsworth Board of Works to appoint representatives to attend a preliminary conference to consider the matter, they being the road authorities concerned.

At the Westminster Guildhall, on 15th inst, the Light Railways Commissioners considered the application for an order for the construction of the Hendon, Finchley, and District Light Railway by the Finchley District Light Railway Company. The line would give the inhabitants of Marylebone, Hampstead, Willesden, and Cricklewood, easy access to the prettiest parts of Hampstead Heath and the new park at Golder's Hill. The inquiry was adjourned.

Newcastle.—The New Tramways Committee of the Corporation met on 17th inst., when a communication was read from Prof. Kennedy, who intimated that he was going to America after the 25th of this month, on behalf of the London County Council, and suggested that the Committee should wait until he returned, after inspecting the various systems of trams in use in the United States, when he would be able to report on the conditions existing in Newcastle with a fuller knowledge at his disposal. He would be absent all April, and would not be able to report until two months after his return. If, however, the Committee wished to see him before his departure, he would be glad to meet them. The Committee agreed that it would be advisable to see Prof. Kennedy before his departure, and he will, therefore, be invited to visit Newcastle at an early date, along with Mr. Charles Hopkinson, when he will examine the whole of the ground for the proposed system, and report to the Committee. The question as to the appointment of a permanent electrician was left over for the present.

Portsmouth.—Messrs. J. Kincaid & E. Pritchard have been retained to value the tramlines, &c., and give evidence before the arbitrator who is to determine the amount to be paid by the Corporation to the company.

Sydney (N.S.W.).—A financial journal says that the city and suburban steam tramways of Sydney are to be equipped with an electric tram service.

Tower Waggons.—The British Electric Traction Company, Limited, have placed an order with Messrs. J. H. Heathman and Co. for four of their patent tower waggons, with projecting platform at top to work on turntable principle, and adjustable at various heights.

The Waterloo, Euston and Paddington Railway.—A large and influential meeting was held on Monday in the Paddington Vestry Hall, which passed a resolution emphatically protesting against the Bill of the Baker Street and Waterloo Railway Company, re-named the Waterloo, Euston and Paddington Railway Company, introduced into Parliament this session, and having for one of its chief objects the erection of a station for generating electricity and the construction of a terminal yard in the most picturesque part of Paddington, both of which, it was considered, will most prejudicially affect not only the immediate neighbourhood as a residential centre, but the interests of all persons carrying on business in the district.

TELEGRAPH AND TELEPHONE NOTES.

African Trans-Continental Telegraphs.—Mr. Rhodes has been busy during his stay in Germany in connection with the North to South railway and telegraph schemes, so far as concerns the section to cross German East Africa. Herr Von Bulow's statement in the Reichstag is given by the *Standard* Berlin correspondent as follows:—"As regards the laying of a North to South telegraph through German East Africa, and in connection with the already existing South African line, an agreement has been arrived at between the Trans-African Telegraph Company and ourselves. The coming into force and the publication of this agreement are dependent on the course of other negotiations; but I may say at once that it safeguards our sovereign rights and interests in every respect. The Trans-African Telegraph Company is permitted by this agreement to lay the wire in question through German territory at its own expense. It must be laid within five years at the most. The officials and workmen of the company are made liable to the German laws, and have to obey the regulations of the German Governor during their stay in German East Africa. The company is also bound to lay a wire between the two stations in Rhodesia and British East Africa which are nearest to the German frontier at its own expense. This wire is intended for the purposes of telegraphic communication from German East Africa, and will become the property of the German Government. The cost of its maintenance is to be defrayed by the German Government, which is entitled to lay more wires at its own expense. For the rest, the telegraph wires are to be maintained by the German Government at the company's expense. The German Government reserves the exclusive right of establishing and managing telegraph stations in East Africa. After the lapse of 40 years the German Government can take over the line gratis."

Reuter's agency understands that by the arrangement concluded between the German Government and the Trans-African Telegraph Company, the latter will carry on their poles a second wire for the sole use of the German Government, this second wire starting from the most northernly Rhodesian station, near Abercorn, to the south of Tanganyika, and terminating at the point where the trunk line again enters British territory in Uganda.

A Cable between Manila and Iloilo.—The Eastern Extension Telegraph Company announce, says the *Times*, that their Manila-Panay cable has been extended to Iloilo, thus establishing direct cable communication between Manila and Iloilo. The company's cable connecting the island of Negros with Iloilo has also been re-opened for public traffic.

Cable Traffic with Japan.—We have converted into sterling the amounts given by the *Financial News* as showing the increase in the telegraph business from Japan. The following table, showing the annual development of the outlay on account of cablegrams from Japan to the West since 1891, is published in the *Jiji Shimpo* in the course of an article advocating an alternative line of telegraph communication:—

	Yen.	£ s. d.
1890	355,750 ..	77,449 14 9
1891	367,801 ..	80,029 15 11
1892	434,625 ..	94,621 9 7
1893	524,565 ..	114,202 3 4
1894	556,070 ..	121,061 9 8
1895	1,012,064 ..	220,335 3 6
1896	1,126,633 ..	245,277 16 0
1897	1,379,945 ..	300,425 11 0
1898	1,639,433 ..	356,918 2 0

Commenting on these figures, the *Japan Mail* says:—"There is a curious feature in this table. The sudden leap from 500,000 yen in 1894 to 1,000,000 yen in 1895 is, perhaps, accounted for when we remember that the war with China broke out in July, 1894, though the same cause ought to have produced a proportionate expansion in 1894 as compared with 1893. But how is it that the increase has continued ever since? In 1895, as compared with 1894, we have a growth of nearly 100 per cent., and in 1898 as compared with 1895 we

have a growth of over 50 per cent., whereas from 1890 to 1894 the growth was only 56 per cent. of a much smaller figure. We presume that the explanation is to be sought in the remarkable expansion of Japan's foreign trade during the past four years."

The Chambers of Commerce and Telegraph Matters.—The Association of Chambers of Commerce on 16th had a discussion on the question of the Anglo-French telegraph rates, which were considered excessive and unwarranted. The meeting also passed a resolution impressing upon the Government the necessity of aiding, as far as possible, in the establishment of "telegraph routes between this country and the Colonies, and between the Colonies themselves respectively, without such routes passing through other countries," and with that object in view, the Government was respectively urged to at once join Canada, the Australian and other Colonies, in carrying out a Pacific submarine telegraph cable, as being a material portion of the scheme.

Communication with the Yukon.—A *Times* despatch from Ottawa said that on the 11th inst. a party of electricians was to leave there under the orders of the Dominion Government, to begin the construction of a telegraph line from Skagway to Dawson. By November 15th, it is expected, the line will be completed and Ottawa will be brought within six days' communication of the new goldfields. The estimated cost of the work is $150,000. Subsequently the line may be connected with the Government's system of telegraphs in the North-West.

New Submarine Cable in Japanese Waters.—The *Board of Trade Journal* says that the Board of Trade have received through the Foreign Office notice that a submarine cable has been laid between Kuzuha, Moji, Kikiu District, Buzen Province, Fukuoka Prefecture, and Deshimochi, Hikojima Village, Toyoura District, Yamaguchi Prefecture (Japan). A chart of the district may be seen by those interested at the Commercial Department of the Board of Trade, 7, Whitehall Gardens, S.W., any day between the hours of 11 a.m. and 5 p.m.

Soudan Telegraphs.—According to despatches to the daily press the extension of the telegraph line in the Soudan is proceeding rapidly. A station is now open in the vicinity of Abu Harraz, on the Blue Nile, about midway between Khartum and Gedaref.

Soundings in the Pacific Ocean.—We learn from the San Francisco press that the United States ship *Ranger* will soon be actively engaged in preparing the way for better communication between this country and the Philippines. Orders have been issued from Washington that the cruiser be prepared to go into commission, and the work will be commenced without delay. The *Ranger* is now at Mare Island, where she has been laid up for a number of years. She was formerly engaged in survey work along the coast of Lower California, but was replaced by the *Thetis*. The *Ranger* is now detailed to make deep-sea soundings between Honolulu and Guam and Guam and Manila, the object in view being the survey of a suitable cable route. Soundings have already been taken between here and Honolulu, and when the *Ranger* has completed her work it will be but a short time until all the Pacific possessions will be in direct communication with the mother country. Commander Charles Belknap, U.S.N., will have charge of the *Ranger*, assisted by Lieut. H M. Hodges, who has been ordered to join the cruiser as executive officer.

SS. "John Pender."—We understand that the cable steamer *John Pender*, lately the property of the Eastern Telegraph Company, has been re-named ss. *Clifton*, and is offered for sale by Messrs. Pile & Co., of 34, Great St. Helen's, E.C., after having received extensive alterations to convert her into a cargo boat.

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Amazon Company's cable—		
Cable beyond Gurupa ...	June 11th, 1898 ...	...
French Company's cables—		
New York-Hayti ...	Feb. 10th, 1899 ...	...
Paramaribo-Cayenne ...	Feb. 10th, 1899 ...	...
Cayenne-Pinheiro ...	March 10th, 1899 ...	...
Dakar-Bathurst	Feb. 9th, 1899 ...	March 15th, 1899.
Landlines.		
Saigon-Bangkok	March 7th, 1899 ...	March 17th, 1899.
Ditto	March 18th, 1899 ...	March 20th, 1899.
Moulmein-Bangkok ...	March 15th, 1899 ...	March 16th, 1899.
Majunga-Tananarive ...	March 14th, 1899 ...	March 16th, 1899.
Communication between Mossamedes and all Inland Offices.	March 16th, 1899 ...	...

The Telephones Bill.—From a statement made in the House of Commons by Mr. Balfour the other day, it seems that the Government Telephones Bill will not come on before Easter.

Worcester and Chester Corporations are assisting in the movement to get the power to municipalise the telephone extended to all county boroughs instead of it being confined to those having a population of 50,000.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—The Corporation wants tenders for two Babcock boilers, one 180-kw. steam dynamo, and one 75-kw. balancing set. See our "Official Notices" March 17th.

Aberdeen.—March 29th. The Corporation wants tenders for permanent way, overhead line work, feeder and test cables, cars, switchboard, &c., for electric tramways. See our "Official Notices" March 10th.

Aberdeen.—March 29th. The Corporation are prepared to receive tenders for the supply of the following materials for the equipment of their Woodside tramway route:—400 tons steel girder rails, 20 tons fishplates. Copies of the specification, &c., may be obtained from Mr. William Dyack, burgh surveyor, Town House, Aberdeen.

Ambleside.—Tenders are, according to an exchange, about to be invited for gas engines, generators, boosters, switchboard and battery, and mains for electric lighting at Ambleside. Intending tenderers should send their names to the engineers, Messrs. Hopkinsons & Talbot, 26, Victoria Street, S.W.

Barking Town.—March 27th. The Urban Council wants tenders for an 80-kw. steam dynamo (vertical high speed enclosed engine and two-pole dynamo), with pipe-work and accessories. See our "Official Notices" March 10th.

Belfast.—The Harbour Commissioners want tenders for the construction and erection of two overhead tramways on the Queen's Quay, Belfast. Specification, &c., may be obtained from the Harbour engineer, Mr. G. F. L. Giles.

Derby.—March 30th. Tenders are wanted for an overhead hand crane for the electricity works. See our "Official Notices" March 17th.

Doncaster.—March 28th. The Corporation wants tenders for three Lancashire boilers, several sets of steam dynamos, overhead crane, condensing plant, storage batteries, electrical instruments, cables, street boxes, &c. See our "Official Notices" March 17th.

Edinburgh.—April 3rd. The Corporation want tenders for water-tube boilers. See "Official Notices" March 17th.

Edinburgh.—April 10th. The Corporation wants tenders for the electric lighting of the City Chambers. See "Official Notices" this week.

Lewes.—March 24th. The Corporation is prepared to receive offers from those willing to establish an electricity supply undertaking. See our "Official Notices" February 17th.

Morecambe.—The District Council wants tenders for mechanical stokers for two Babcock boilers. See our "Official Notices" March 17th.

Peterborough.—April 20th. The Corporation wants tenders for Lancashire boiler, steam dynamos, balancers and boosters, switchboard, battery, piping, cables, &c.

Poplar.—April 25th. The Board of Works wants tenders for engine and boiler house plant, battery equipment and street lighting. See "Official Notices" March 17th.

Rochdale.—April 12th. The Guardians want tenders for an electric light installation at the Workhouse buildings and cottage homes. See our "Official Notices" this week.

Rothsay.—March 27th. The Town Council wants tenders for 220 H.P. coupled engines and dynamos, switchboards, cables, arc lamps and posts, feed pump, steam and exhaust pipes, &c. See our "Official Notices" March 10th.

Southend-on-Sea.—April 6th. The Corporation wants tenders for the "temporary" transfer of their 1891 Electric Lighting Order. See "Official Notices" March 3rd.

Spain.—April 20th. The municipal authorities of Santiago are inviting tenders for the supply and erection of the plant for a central power station to be erected near the town to utilise the water-power of the River Tambre for the generation of electrical energy for lighting and power purposes. Particulars may be obtained from, and tenders are to be sent to, El Presidenté del Consejo de Administracion Santiago, Spain.

Sunderland.—March 30th. The Corporation wants tenders for India-rubber covered cables, cast-iron and wrought-iron pipes and street service boxes, stoneware castings and bearers, house fuse boxes. See our "Official Notices" March 10th.

Sutton and Howth (Ireland).—April 20th. The Great Northern Railway Company wants tenders for works in connection with their line between Sutton and Howth, near Dublin, including the supply and laying of feeders, returns, &c., rolling stock, overhead construction, battery and booster, &c. See our "Official Notices" this week.

Tynemouth.—The Corporation wants tenders for boilers, economisers, condensers, pumps, pipe work, water cooler, crane, switchboards, accumulators, cables, and traction steam dynamo. See our "Official Notices" March 17th.

(*Continued on page* 470.)

BLACKBURN CORPORATION TRAMWAYS.

Some two or three years ago the local tramway company decided to equip their lines for electrical working, and after negotiation with the Corporation, decided to purchase the necessary electrical energy from the already existing municipal works. The Corporation not only proposed to furnish current, but were also to erect all the overhead wires, poles and other structures, as well as the bonding of rails, laying of feeders, &c. The tramway company was to provide its own rolling stock and motor equipment, receiving from the Corporation an extended lease of lines. But on going more closely into the subject, the municipality became convinced that it was desirable to purchase the tramways, and eventually this was done, and sometime afterwards the contract for completely equipping a portion of the line was given to Messrs. Siemens Bros., Limited.

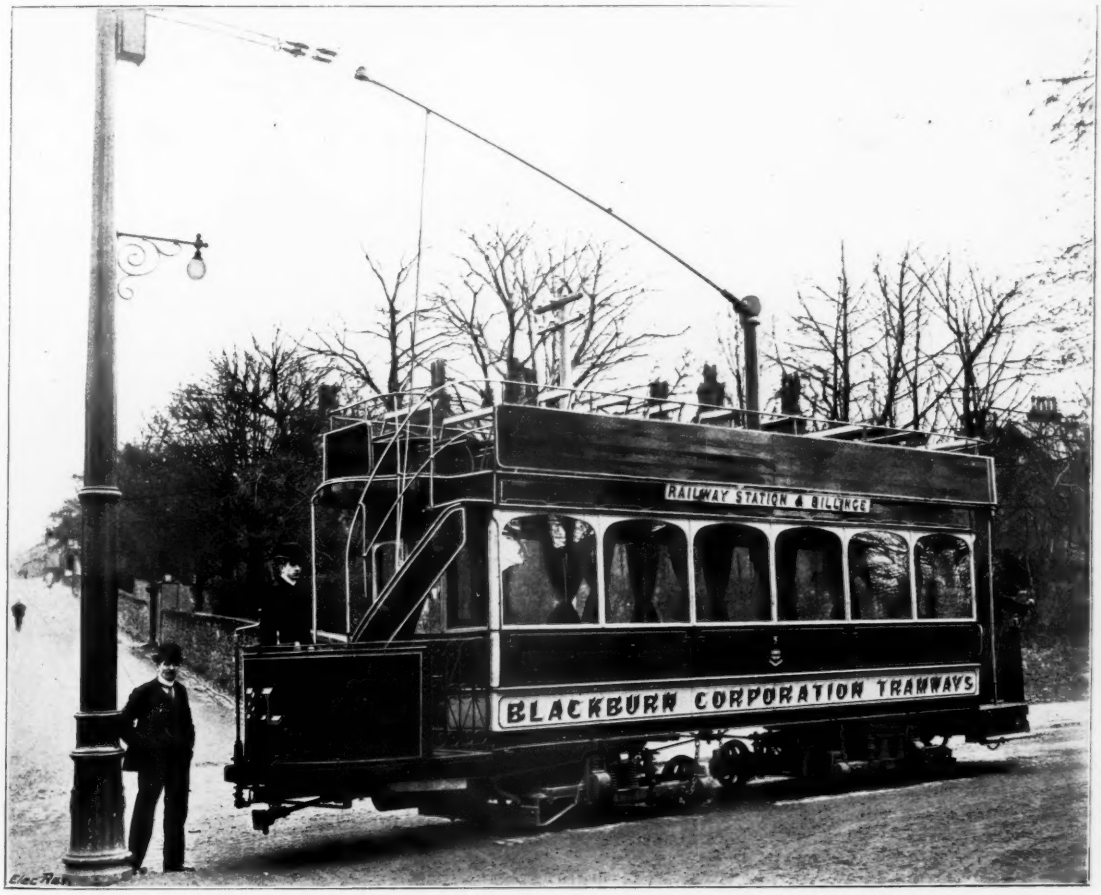
A short length has now been completed, and the following details will be of interest. The chief features of the construction are that the whole of the apparatus, with the exception of the car trucks, has been made in this country; that is to say, for the first time in the history of modern electric tramways English contractors have manufactured motor equipment, car controllers, and the usual paraphernalia.

The contract for installing the tramways at Blackburn has been carried out by Messrs. Siemens Bros. & Co., Limited, under the supervision of Messrs. Lacey, Clirehugh & Sillar.

The generating plant, as was to be expected, is at the Corporation lighting works, which, as our readers know, has existed for some few years.

The engines consist of two sets of Belliss two-crank compound engines, each indicating up to 250 H.P., working non-condensing with 115 lbs. of steam at the stop valve, when running at 380 revolutions per minute. These engines consume 22 lbs. of steam per I.H.P.-hour, and are so governed that the variation in speed is 1·9 per cent. from full to no load.

Both engines were tested at Messrs. G. E. Belliss & Co.'s works, and subsequently at the station after erection, with highly satisfactory results. The economical performance was found to be fully up to specification requirements,



Car on Line.

and the results of the governor trial were somewhat remarkable, as is shown by the following statement :—

Results of Governor Test.—Variation in speed, the load being switched off and on as suddenly as possible.

Change of load.	Revolutions per minute.			Percentage of variation in speed.	
	From.	To.	Settle.	Momentary.	Permanent.
Full to none ...	380	389	387	2·3 %	1·8 %
Half to none ..	384	390	387	1·57 %	7·8 %

It will be noticed that with the full load thrown off as suddenly as possible, the momentary variation of speed was

only slightly in excess of, and the permanent variation rather less than, 2 per cent. Taking the half-load speed as the mean speed, it follows that the greatest departure from the mean speed under any conditions of load is only $1\frac{1}{2}$ per cent. momentary and less than 1 per cent. permanent.

Pole fitted through Salford Bridge Foundation.

Direct coupled to each of these is one of Siemens's HB 24/32 compound wound dynamos of 120 kw., each machine being so arranged that it may be used either for tramway work at 550 volts, or for lighting at 250 volts. For this purpose each machine has two commutators, and two separate windings on each armature, and on the side of the machines are fixed switch frames, with the necessary arrangements for coupling these windings in series or in parallel, and also for connecting these circuits thus arranged to either the traction or lighting bus bars.

In the tests made on these machines, they give a final temperature of 60° F. rise above the atmosphere after a run of 16 hours at 140 amperes and 550 volts.

The tramway switchboard consists of seven enamelled slate panels, mounted in substantial cast-iron frames, there being two machine panels, three feeder panels, one return feeder panel, and one Board of Trade testing panel.

These panels carry the following instruments:—

Machine Panels.—One double-pole 200-ampere knife switch; one single-pole 200-ampere knife switch; one maximum current cut-out for 250 amperes; one field breaking switch; one field regulator and switch; one ammeter for 250 amperes.

Feeder Panels.—One ammeter for 220 amperes; one 200-ampere knife switch; one 200-ampere fuse.

In the centre panel are the two voltmeters, reading 450 to 550 volts, while the Board of Trade testing panel is provided with two recording ammeters reading 0 to 20, and 10 to 220 amperes, two recording voltmeters reading 0 to 10 and 450 to 550 volts, and two watt-hour meters.

The following are the details of the cables and feeders laid for the tramways:—

Length.	Section.	Distribution.
3,330 yards.	·15 sq. in.	G S. to Billinge.
136 ,,	·2 ,,	,, ,, Jubilee Street.
1,340 ,,	·2 ,,	,, ,, Witton.
550 ,,	·2 ,,	,, ,, ,,
365 ,,	No. 310 R.	,, ,, trolley wire.
120 ,,	·3 sq. in.	,, ,, rail return.
5,640 ,,	9/19	(pilot wire).

About every half-mile along the track cast-iron boxes are erected on the side of the pavement. The feeders from the station lead up into these, and are connected to a bus bar mounted on a slate base on porcelain insulators. From this bus bar four high tension switch fuses connect with the section insulators on the trolley lines by cables leading up the inside of the posts. A lightning arrester is connected between the bus bars and earth. Terminals from the pilot wire are also brought up on to this slate base for portable telephonic connection and testing purposes.

Section Pole and Section Pillar Box.

There are, approximately, $3\frac{3}{4}$ miles of track, the rails being mostly of 88 lbs. per yard section, though wherever new track has been laid, heavier sections have been adopted.

The rails are mostly single bonded with the "Neptune" type of bond, having a cross-section of ·166 square inch. A small portion of the track is double bonded. These bonds vary in length from 22 inches to 30 inches, according to the length of the fishplates. Cross bonding between rails, and also between tracks, is carried out about every 100 yards.

Messrs. Lacey, Clirehugh & Sillar have given very special attention to the design of the poles and arrangements for the overhead line, and an inspection of this part of the work will go far to remove any objections on æsthetic grounds which can be urged against the overhead trolley system.

It is carried out on the double trolley wire system, with side posts and brackets. Where possible, centre posts are used, with double bracket arms. The posts are of four grades in strength, in order to meet the varying lateral stresses occasioned by curves, &c.

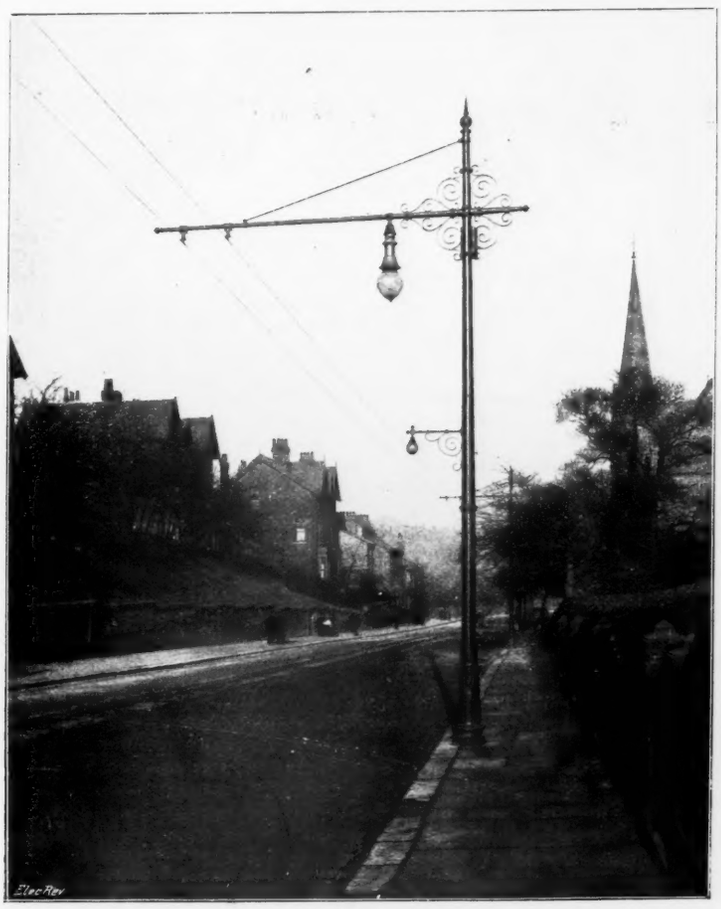
The two lighter types of poles used for carrying brackets, consist of two lap-welded taper steel tubes shrunk together, with a cast-iron ornamental moulding placed over the joint.

The two heavier types, used for pull-off and anchor posts, are made up of three parts shrunk together in the same manner.

All the poles have cast-iron ornamental bases and ornamental brackets, their decoration consisting of wrought-iron scrolls fixed in the four angles between the body of the pole and the bracket arm.

The bracket arms vary in length from 5 feet in the centre pole construction to 16 feet in the case of side pole construction. Throughout the route these poles are used for carrying arc and incandescent lamps for street lighting, about every fourth pole being fitted with a carrier containing an arc lamp, whilst the intermediate posts have two brackets for 32 C.P. incandescents.

Double-Arm Bracket Pole.



Single-Arm Bracket Pole.

The trolley wire is supported on what is known as the "rigid" system, the wires in every case being attached to hangers on the bracket arms, no span wire being used.

Double insulation is used throughout, sleeves of insulating material being inserted between the metal of the hanger and the bracket arm.

The trolley wire is No. 0, B and S gauge, soldered to 15-inch gun-metal ears. Where telegraph or telephone wires cross the trolley wire, guard wires of a special form are used.

The trolley wire is suspended at a height of about 21 feet 3 inches above the track at the bracket arms, and the length of span averages about 125 feet.

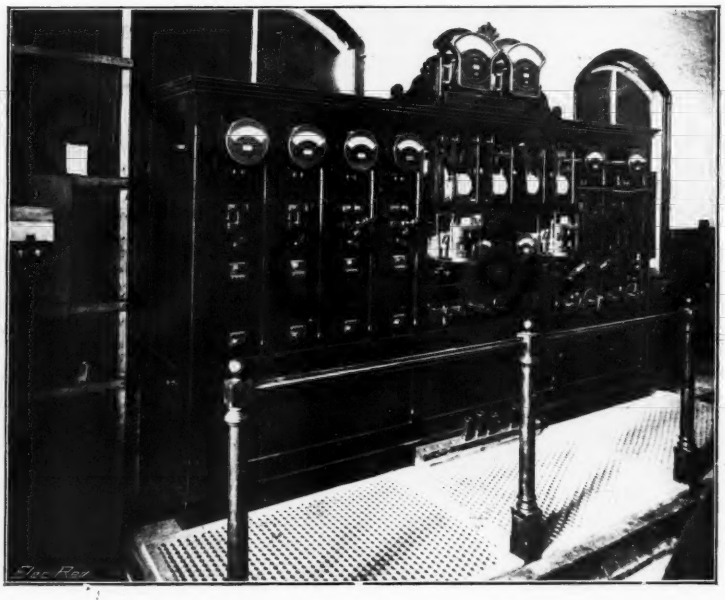
The rolling stock consists at present of eight cars, the car bodies being made by Messrs. G. F. Milnes & Co., Limited, of Birkenhead. They are double decked, each capable of seating 60 passengers. The car bodies are mounted each on two Brill maximum traction bogies supplied by Messrs. Laing, Wharton and Down.

Each bogie is fitted with one of Messrs. Siemens's water-tight ironclad traction motors, the method of supporting the motors being what is known as the "nose" suspension.

These motors are each capable of exerting a pull of 1,100 lbs. for one hour continuously at the tread of a 30-inch wheel, at $6\frac{3}{4}$ miles per hour without overheating.

The weight of these motors is about 17 cwt. with gear and gear case.

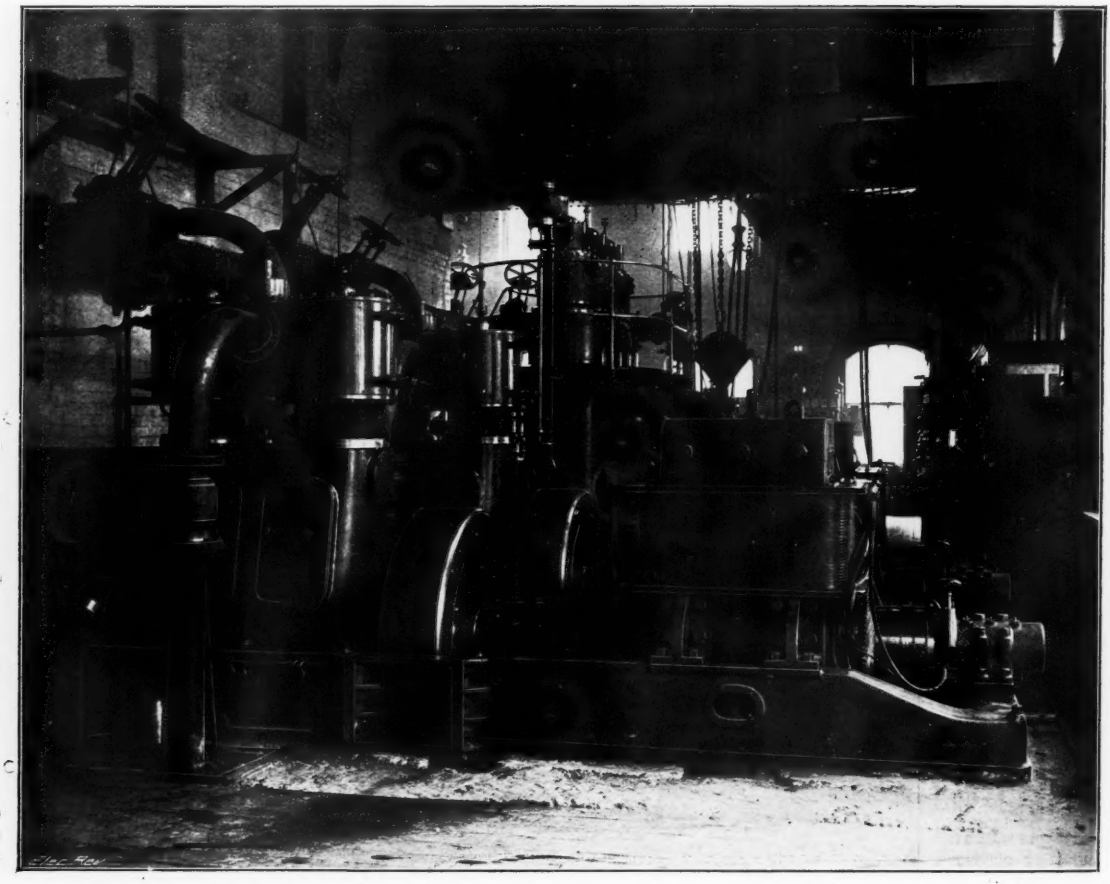
The magnet case is of steel, cast in two halves, each half containing two of the four poles of the motor, which has four wound poles. This case is easily opened, giving immediate access to any part of the machine. Besides this there are two doors, one above and one below the commutator, so that the brushes may be easily got at. The brushes are of carbon, and the brush-holders follow up the wear of the commutator, so that the current does not have to traverse long lengths of carbon when the commutator is reduced in diameter. The commutator segments are of hard drawn copper, and are of sufficient depth to allow for 2 inches reduction in diameter.



Switchboard.

The gearing consists of a forged steel pinion of 19 teeth and $4\frac{1}{2}$ inches width of face, accurately cut from the solid, gearing into a cut cast-steel spur wheel of 90 teeth, the two giving a gear ratio of 4·74 to 1. These gears run in oil in a cast-iron oil-tight case, fitting over the motor spindle bearing as well as the car axle bearing.

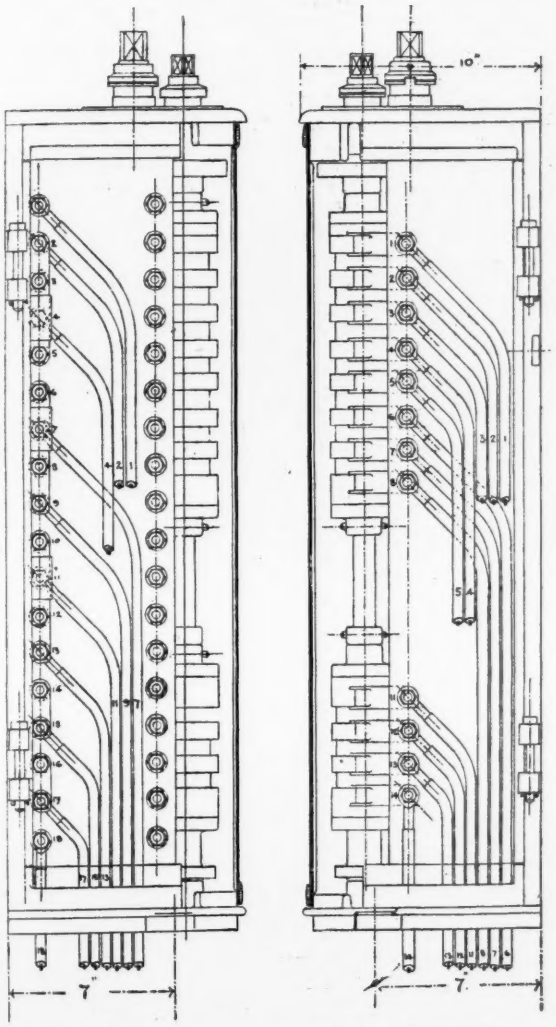
The controllers are Siemens's series parallel shunt type. The various arrangements of motors in series and parallel are made by means of a number of quick-break switches, specially designed for high tension currents, having patent renewable carbon contacts. These switches are actuated in the necessary order by means of cams mounted on one shaft, and provided with a removable controlling handle. This controller gives nine working positions. The case of the controller also contains the reversing barrel, interlocked with the controller proper, so that the reversing



Power House.

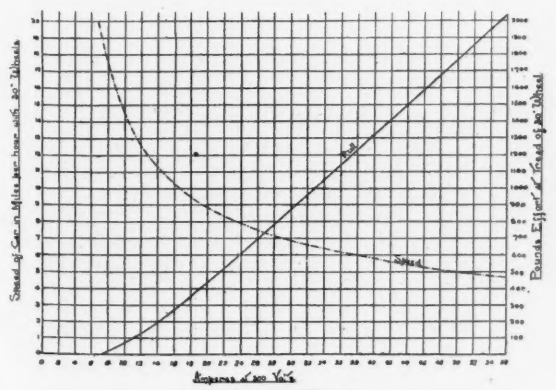
lever can only be operated when the latter is in the off position.

A separate switch barrel is provided in each controller for



Controller.

the purpose of cutting out a defective motor in the event of its being disabled, and the car may be brought home by means of the remaining motor.



Curves of Motors.

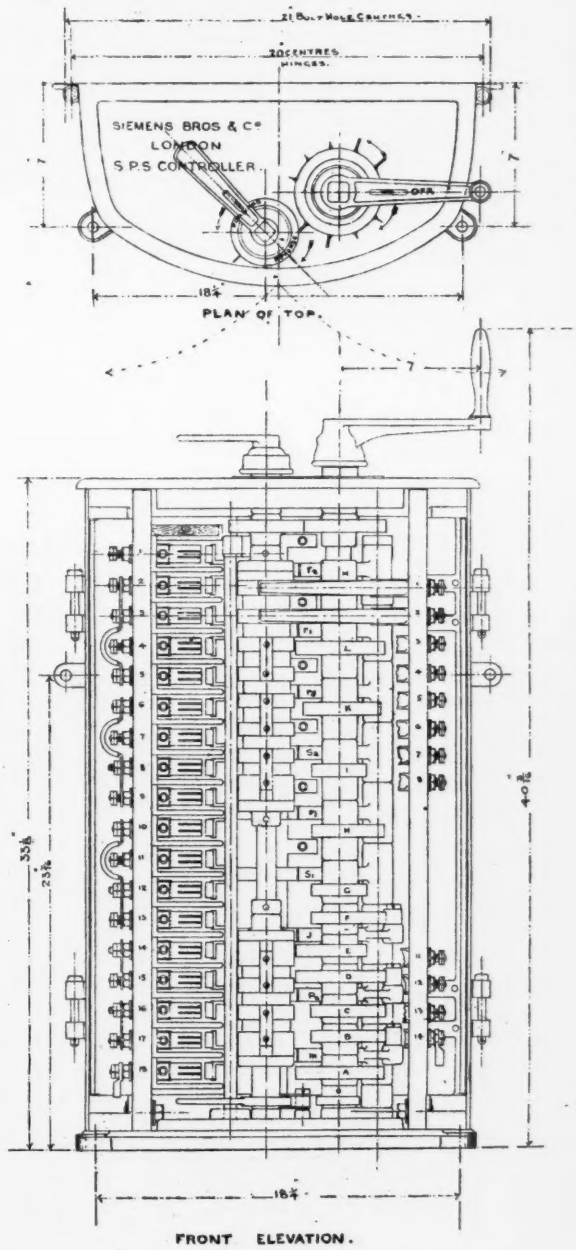
The overhead collector gear is of the swivelling type, and consists of swivelling trolley head, mounted on a weldless taper steel tube. The trolley wheel runs on a patent "metalline" bush, needing no lubrication, and giving, it is stated, better electrical conductivity than those using a lubricated bearing.

The framework carrying the bearing swivels round a vertical axis being carried on a single row of balls. The standard carrying the pole consists of a steel tube fixed to a malleable cast-iron base, within which a second steel tube rotates on balls, and carries the spring.

To the top of the inner tube is fixed the casting which carries the trolley pole socket. The spring is readily adjustable through hand-holes in the base.

A catch is provided for holding the pole in a horizontal position when required.

The lighting of the cars is carried out by means of 10 16-C.P. lamps contained in bulkheads on the inside of the



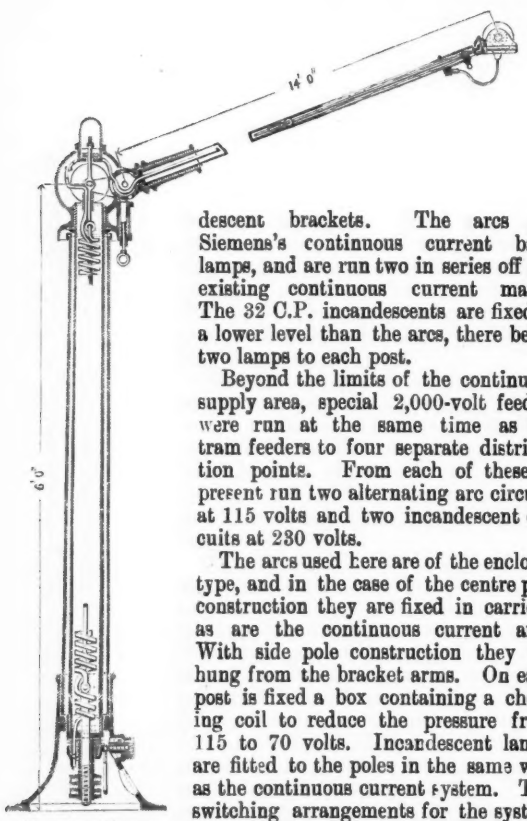
Controller.

roof. These are arranged in two circuits of five each. The switches actuating these are placed in tool lockers on the platforms at the end of the cars. The two main switches are carried under the canopy at each end, and consist of a high tension carbon quick-break type, controlled by a powerful spring, the catch of which is released by the pull of a cord within reach of the driver. Besides the above, each car

carries a watt-hour meter, two main fuses, lightning arrester and choking coil, &c.

As previously mentioned, the posts for the tramway are utilised for a very complete system of street lighting.

Within the existing continuous current supply area, this is effected by means of arcs fixed in carriers, and incandescent brackets. The arcs are Siemens's continuous current band lamps, and are run two in series off the existing continuous current mains. The 32 C.P. incandescents are fixed at a lower level than the arcs, there being two lamps to each post.



Trolley Pole.

Beyond the limits of the continuous supply area, special 2,000-volt feeders were run at the same time as the tram feeders to four separate distribution points. From each of these at present run two alternating arc circuits at 115 volts and two incandescent circuits at 230 volts.

The arcs used here are of the enclosed type, and in the case of the centre pole construction they are fixed in carriers, as are the continuous current arcs. With side pole construction they are hung from the bracket arms. On each post is fixed a box containing a choking coil to reduce the pressure from 115 to 70 volts. Incandescent lamps are fitted to the poles in the same way as the continuous current system. The switching arrangements for the system are contained in cast-iron pillar-boxes near the transformer pits. These contain the necessary switches and fuses for each of the four circuits, and also the switches in the high tension circuit of the transformers. Each of these pillar boxes has two doors, giving access to both back and front of the board.

The curves of the car motors show the relations between pull and current and speed and current. An examination of these curves will show that the feature of this motor is the large starting effort available with a comparatively small current. This will be found especially suitable at Blackburn, where some of the gradients are very severe and the cars heavy.

The motor is a slow-speed one. The controller, however, is arranged to shunt the fields of the motors, when required. With this increase of speed at hand when needed, the speed will be amply high enough for English street requirements.

CONTRACTS OPEN AND CLOSED.

(*Continued from page* 464.)

West Hartlepool.—April 15th. The Corporation invites offers from those prepared to undertake free wiring of premises. See our "Official Notices" this week.

CLOSED.

Greenock.—The Electric Lighting Committee of the Police Board has given out contracts for the electric lighting installation as follows, the total amount being £30,000:—Buildings, John M'Ewan; mains, &c., Callender's Cable and Construction Company; engine house plant, the India-Rubber, Gutta-Percha, and Telegraph Works Company; boilers, Messrs. Babcock & Wilcox.

Germany.—Messrs. W. Lahmeyer & Co., of Frankfort-on-Main, submitted the lowest tender for the supply and erection of the electric lighting plant required at the municipal abattoirs at Wiesbaden. Ten other German firms competed for the contract.

London.—The St. Pancras Vestry received the undernoted tenders for wiring the premises of the Labour Bureau:

	£	s.	d.
Laing, Wharton & Down	20	8	0
Pritchetts & Gold	26	10	0
Bersey & Co., Limited	31	17	0
Benham & Son, Limited	39	0	0

The lowest tender has been accepted.

London County Council.—The Electrical and Highways, &c., Department have placed an order with Messrs. Foxcroft and Duncan, of Dalston, for 18 of their "Sappho" enclosed arc lamps for the lighting of the pumping station at Crossness. We are informed that the lamps were chosen after trial against other types.

FORTHCOMING EVENTS.

Friday, March 24th.—At 5 p.m. Physical Society. 1. "On the Criterion for the Oscillatory Discharge of a Condenser," by Dr. Barton and Prof. Morton. 2. "The Minor Variations of the Clark Cell," by Mr. A. P. Trotter.

At 7 p.m. Institute of Marine Engineers. Annual meeting at Stratford.

At 8 p.m. Electro-Harmonic Society Smoking Concert. Last of the season.

Saturday, March 25th.—At 3 p.m. The Institution of Junior Engineers. Visit to the Testing Station of the British Fire Prevention Committee at Hanover Gate, Regent's Park, London.

At 7 p.m. North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne. Paper by Mr. Talbot Duckitt on "The Application of Electricity to Coal Mining."

Tuesday, March 28th.—At 8 p.m. The Institution of Civil Engineers. Paper on "Alloys of Iron and Nickel," by Robert Abbott Hadfield, M.Inst.C.E.

Wednesday, March 29th.—At 3 p.m. Chemical Society, Burlington House. Anniversary meeting, election of officers and council. President's address.

NOTES.

The Easter Holidays.—Owing to the intervention of Eastertide, the next issue of the Electrical Review will be published on Thursday morning instead of Friday. All matter for the advertisement and editorial pages should therefore reach this office a day earlier than usual.

The Electro-Harmonic Society.—The concert this evening is the last of the season '98-99, and in consequence members and friends will probably muster in goodly numbers. The programme is varied, and with orchestral selections, instrumental solos, good singing, and ventriloquial and humorous sketches, there should be something to please everybody. It will surprise many to learn that we have reached the end of the thirteenth season of these enjoyable concerts.

The Victoria Accumulator.—With reference to our correspondent's correction in last week's issue, the Eclipse Brass and Copper Company write as follows:—"We have only to thank your correspondent for correcting the error which has been made through our oversight. The rate of discharge is a little under ·07 per square inch of total positive surface. As regards the diagram with such small divisions, it is easy to make an error. Thus, at the end, the rate of discharge per watt ought to be $3\frac{3}{4}$, which is very difficult to appreciate in the diagram.

$$\frac{51{\cdot}5 \text{ watt-hours}}{3{\cdot}75 \text{ watts}} = 14 \text{ hours.}$$

We think it is desirable that, instead of correcting the present diagram, which is only valuable as a comparison with the Laurent-Cely, it would perhaps be better to furnish another relating only to the Victoria accumulator. If it interests you we will do so."

Electric Cabs in London.—We understand from the *Motor Car Journal* that the London Electrical Cab Company have now completed their new charging plant, consisting of two complete sets of Babcock & Wilcox boilers, Willans engines, and General Electric Company's dynamos, having a total horse-power of 500. They have found this plant a great convenience, and by its means have effected a considerable saving in the cost of current, which previously was taken from the Supply Company's mains. Besides this, under the old arrangement it was only possible to charge the batteries during a few hours after 1 a.m., and consequently many batteries were improperly charged, or the current was put into the batteries too rapidly. By means of the new plant it is possible to continue the charging throughout the day and night if desired, and thus considerable convenience is gained. It is said that the company are about to shut down their works for a fortnight or so, and to call in all the cabs now in the streets. This is for a two-fold reason. First, all the cabs now in the streets are to be overhauled, repaired and re-decorated; and, secondly, more new cabs are to be equipped and fitted up. Slight alterations are also to be carried out at the depôt. About the first week in April the company will again start active operations with at least 80 vehicles plying for hire. In addition they are fitting up a superior form of brougham, the intention being to let out a large number of these vehicles as private broughams for balls, dinner parties, theatres, &c. Our new contemporary says that the freedom from breakdowns is now absolute, and all annoyance on this head is a thing of the past. In addition, most of the difficulties experienced in running the cabs are now removed, and they are being run at a profit, though not a very large one at present. Mr. Walter C. Bersey has now been elected chairman and managing director of the company.

The Telephone Service in Foreign Countries.—A Parliamentary paper has been published containing reports respecting the telephone service in various foreign countries. Mr. A. D. Provand, M.P., suggested 23 questions, the answers to which form the basis of the reports obtained from the Consuls applied to. Reports have been obtained from Austria-Hungary, Bavaria, Belgium, France, Germany, Italy, the Netherlands, Russia, Sweden and Norway, Switzerland, and the United States. Some of the Consuls report considerable difficulty, and consequently delay in obtaining replies to Mr. Provand's questions, but, generally speaking, the replies obtained are full and interesting. The rates for subscribers are given as follows:—Vienna, £8 6s. 8d.; Munich, £7 10s.; Stuttgart, £5; Antwerp and Brussels, £10; Berlin, Frankfort, Leipsic and Hamburg, £7 10s; Rome, £6 14s. In other towns the charges vary with the conditions of use, as for example Christiania with £4 8s. 10d. up to 6,000 calls and an extra charge of 11s. 2d. for every additional 1,000 calls or part thereof; Berne and Geneva, £4 first year, £2 16s. second year, and £1 12s. third year, entitling the subscriber to 800 communications, a further charge of ½d. each being made for additional calls. In Stockholm the charge for an unlimited number of calls is £4 8s. 10d., in addition to an entrance fee of £2 15s. 6d. In New York the charges are for 600 messages £18, 1,000 messages £24, and 1,500 messages £29. Other subjects dealt with are the numbers of subscribers, the populations of the various cities, the rates of pay to operators and workmen, the number of lines attended to by one operator, and various other features, rendering the compilation of interest and value to those who are able to make suitable comparisons and weigh the facts. Some of the translations of technical terms are of interest, as, for instance, the use of the word "receivers" for "switchboard" in the description of the Munich exchange.

Fatality.—Some days ago an engine driver employed at the Chatham and Rochester electric lighting works was killed by being caught between the tail rod of the engine and the gland of the condenser. It seems, from the evidence given before the Coroner, that the deceased got under the barrier and tried to dodge through while the tail rod was in motion, instead of going round. A verdict of "Accidental death" was returned.

The Northern Society of Electrical Engineers.—The annual dinner of the Society was held at the Grand Hotel, Manchester, on Thursday last week. Mr. S. Z. de Ferranti, the new president, was in the chair, there being present many prominent northern engineers. Mr. Henry Edmunds proposed the toast of the President, and Mr. Ferranti, in responding, made some vigorous remarks on municipal trading.

He said the progress of the electrical industry within recent years had been very great in this country—in fact, we could now congratulate ourselves that, instead of being behind other nations, we were in a satisfactory condition of forwardness. America had gone far ahead on matters of electric lighting and traction because of its peculiar local conditions. In this country the fact that the towns were well supplied with gas had in the past been against the general introduction of public electric lighting. It was, however, not because we had been too well served that we had not gone ahead in electric tramway matters, but principally because legislation had deterred people from investing their money in such undertakings. Owing to the tendency for municipalities to monopolise that kind of work, electric traction had not made the headway it otherwise would have done. There were several things that affected the industry of those present, and one of the most serious was the great disadvantage that sprang from the evils of Socialism. Municipalities were more and more supplying the ratepayers with everything they desired, and one of their latest ventures was in the direction of electric lighting. The municipalities claim to have been very successful in electric lighting work, but how was it possible to fail to make a success of an excellent business when it was coupled with a monopoly? Municipal trading in its worst form was the next step, for the municipalities were proposing to sell not merely gas, water, and electricity, but to manufacture the articles essential to the carrying on of such undertakings. He was glad to say there was a strong feeling against that most pernicious form of Socialism, and everything must be done that was possible to put down that apparently growing evil. Another very objectionable feature of municipal action was the practice of inserting special labour clauses in contracts, which regulated the hours of labour, the rate of wages, the methods as to how the masters should deal with their men, and as to how they should conduct their business generally. By heeding the demands of the trades unions the municipal representatives were simply buying votes by the use of public money. Only that day he had a contract offered to him by the committee of a Town Council, who made it a condition of acceptance that they should have the right to call up any of his workmen to discuss the method in which he (the speaker) conducted his business. How, he asked, were English manufacturers to compete with those of foreign countries when they were subject to such conditions? We were free-traders, but we ought to have free trade in this country, and engineers should not be fettered and forced to artificially raise the price of the work they performed. If we were to be limited in this way the country would have no chance in the markets of the world.

Mr. Browett proposed the health of the retiring president, Mr. J. S. Raworth, who was unfortunately absent, Mr. Fawcus, a past president, replied. Mr. Clirehugh proposed "Electrical Industries," which was responded to by Mr. Edward Cowan.

Trade Disputes.—The proposal to hold a conference under the auspices of the Board of Trade to consider how to decrease trade conflicts has been followed up by Mr. Ritchie, President of the Board. He brought the matter before the Employers' Parliamentary Council, with the result that that body has now resolved that while fully appreciating and sympathising with the objects set forth in Mr. Ritchie's letter, and anxious to promote industrial peace, so necessary to national welfare, do not at the present time see their way to the possible formation of a full and satisfactory representation of employers and employed on a Board of Conciliation such as is suggested in the said letter. Mr. S. Woods, M.P., in sending the correspondence to the press, casts the responsibility for the failure of the negotiations upon the Employers' Council.

Insurance against Breakdown.—The National Boiler and General Insurance Company, Limited, now undertakes the insurance of dynamos, electric motors, and other electrical machinery against breakdown. Users of such plant may be protected against risk of accident in the same way as is done by the company in the case of steam engines and boilers. Systematic inspection and supervision of plant will be made, the cost being covered by the premiums. The policy covers up to the amount insured the cost of making good breakdowns of the machine which necessitate its stoppage and prevent it being worked. Another new move of the National Company is to undertake the inspection of electrical machinery, quite apart from the business of insurance. A copy of the printed form may be obtained at the head office, 22, St. Ann's Square, Manchester.

Blundering Somewhere!—Mr. Henniker-Heaton, M.P., has rendered signal service from time to time in connection with his articles exposing what he terms the "Blundering and Plundering" of the Post Office in regard to telegraphic errors and delays. The injustice to which the commercial public is subjected to-day by the repudiation of all responsibility on the part of the Postmaster-General for loss and inconvenience which result from careless discrepancies, ought to be removed. Not long since a loss of £5,000 was incurred by gross carelessness on the part of a telegraph clerk, but the Postmaster-General, having a monopoly, "is accountable to no one." A parallel case comes from the Colonies. An Australian correspondent, "Retals," has drawn our attention to a serious omission on the part of some telegraph company or authority. A London house dispatched a message to the correspondent in question in codal language, but through sheer carelessness (as it would appear) it was received out there with the last word omitted. It is true that concealed on the form somewhere among the printed matter the words "one word short, correction to follow," appeared, but as the missing word was not ascertained until three days later, it is plain that the mistake was not remedied with that speed which such an occurrence would warrant. It seems that, instead of going straight for a "repeat" message, Adelaide was first of all applied to to see if the error had occurred there, the inquiry being afterwards passed on, stage by stage until, it is presumed, it finally reached London. The matter was one of extreme urgency, and the full meaning of the message was only ascertained when it was too late for it to be of any use. Apart from the cost of the cablegram, there is a loss of business running into thousands of pounds also to be reckoned in the account. Such occurrences as these are not likely to lead to the belief that telegraph clerks and operators are "skilled," whether they be in the employ of the G.P.O., submarine cable companies, or the colonies.

Our Engine Trade with Brazil.—In a report to the Board of Trade relating to the British trade in the Sao Paulo district, Brazil, Mr. T. Worthington, the Board's specially appointed commissioner, says that the majority of the stationary engines in Sao Paulo, as in Rio, are, he believes, of British make, but this interesting announcement is followed by one a little less glowing for the British engineer, namely, "whether this will continue to be the case seems doubtful." He cites an illustration of the way business sometimes goes away from us in that part of the world, and from what we read in Consular reports sometimes, we gather that the same thing occurs in other parts of the world as well. Bad packing seems again to be at the bottom of it:—

> Large Brazilian importers and mechanicians had dealt with certain British engine makers for a number of years, doing a regular and considerable business, chiefly in small-sized engines. They had occasion, however, to order a large engine, 100 horse-power, and again one of 150 horse-power; to their surprise, these came out in a deplorable condition, and cost them heavily to set right, not to mention loss of *prestige* with their clients; and still more to their surprise, notwithstanding their long and pleasant relations with the makers, the latter would admit nothing and give them no satisfaction whatever. After this experience they contemplated sending their orders, at least for large engines, to the Continent, confident of no such treatment there, but meantime the traveller of large United States makers visited them and closed a contract for five years. They remarked to me that their English friends, so far from sending a traveller, would hardly take time to speak to them when they went to see them in England, although their account was worth £20,000 per annum.

Appointments.—There were 91 applications received for the appointment of a manager for the new municipal electric tramways at Hull at £300 a year. Mr. W. J. McCombe, of the Belfast Street Tramways Company is recommended for the post.

Mr. J. Pilling, chief assistant at Bolton, has been appointed resident electrical engineer at Lynn.

Wages in the Engineering Trade.—The *Times* says that the engineering employers of the north-east coast, replying to the request of the Amalgamated Society for an advance in wages of 2s. per week, have replied that they cannot accede to the demand, as expenses are heavy.

Obituary.—In Mr. Jeremiah Head the engineering world has lost another of its leading men. From his very initiation into the profession, when he as a youth entered the works of Stephenson's, of Newcastle, he seems to have distinguished himself in the domain of mechanical science. The designing of bridge work and agricultural machinery were among his special lines of operation, while he possessed a marked aptitude for dealing with labour problems, a gift which stood him in good stead when the labour market was in an exceptionally unsettled state, for by means of a profit-sharing scheme he cast oil upon the troubled waters and prevented troublesome developments at his own works. We have not space to do justice to his great knowledge of the English and American iron and steel industries, nor to enumerate the many scientific societies with which he was associated. It will be remembered that in 1893 he was president of the Mechanical Science Section of the British Association, and about eight years previously he, as president, piloted the Institution of Mechanical Engineers through a stormy period. He also founded the Cleveland Institution of Mining Engineers. From these few brief comments it will be observed that into a life of 65 years Mr. Head crowded a remarkable amount of thoroughly good work.

By death there is also removed in the person of Capt. Samuel Trott, one who has spent the last quarter of a century upon the sea, actively engaged in submarine cable work, chiefly as captain of the Anglo-American Telegraph Company's *Minia*. From his early teens he devoted himself to a sea-faring career, and gave evidence of marked ability which destined him for a place of command. The success with which he carried through the repair of various telegraph cables against almost overwhelming odds, led to his being deluged with congratulations. His lengthened and varied experience on the *Faraday* and *Minia* in connection with the laying and repair of the Atlantic line, made him a man of rare knowledge in the very important branch of telegraphic operation to which he was devoted. His death occurred in Florida on 11th inst. at the age of 67. Our readers, and particularly cable men, will doubtless receive the intimation of his passing with as deep feelings of regret as we ourselves record it.

A Question of Age.—The New York *Electrical Engineer* asks the question, "Do we age more quickly than our forefathers did?" So far as the Electrical Review is concerned, we know nothing of ageing. Though the oldest electrical journal, we can yet congratulate ourselves on as much vitality as any. But our contemporary does not, we find, refer to journalistic grey hairs, although there was a time when the comparative ages of electrical journals gave rise to a mighty debate and a good deal of recriminatory talk among American electrical editors. Our newly-wed contemporary is really concerned about the prevention of old age, this interesting question having recently been raised in the London *Lancet*, and it quotes Dr. Julius Althaus, who says the only way is to be careful to appropriate and use the galvanic current, which he has studied and experimented upon over 40 years, and lays the charge against doctors of having far too long neglected electricity in cases of debility and exhaustion, in which he himself has often obtained results. He has known men prematurely aged, after treatment look 10 years younger, be restored in temper, take fresh interest in life, and have quicker digestion and healthier sleep. We trust that the new experience of being the New York Siamese twin publication will have so invigorating and soothing an influence upon the mind of our contemporary that it will no longer trouble itself about its age.

New Journal.—We have received the first number of the *Motor Car Journal*, which is a weekly paper containing illustrated articles and general news regarding the progress of the motor car industry. Among a number of interesting items, the first issue contains an illustrated article on the electric cabs of Paris, and the first of a series entitled "Leaders in Mechanical Road Traction," Herr G. W. Daimler being the subject of the sketch.

Society of Arts.—On Wednesday evening Mr. Philip Dawson read a paper on "Electric Traction" before the Society, Sir Frederick Bramwell presiding.

Personal.—We understand that Mr. Herbert A. Jones, who has been for many years with the E.P.S. Company, formerly in their laboratory, and for the past six years as technical and commercial representative in the North, is resigning that position to take over the management of the Phœnix Dynamo Manufacturing Company, of Bradford.

Lectures.—Before the Dewsbury branch of the Yorkshire Engineers and Firemen, Mr. J. W. Garside, electrical engineer to the Brighouse Corporation, lectured on "Electricity." He dealt more particularly on the use of electricity for mill lighting and for power purposes.

Before the Mason University College Engineering Society, Birmingham, on 16th inst., Dr. D. K. Morris read a paper on "Electric Traction in Switzerland."

The Rejected Power Bills.—An excellent letter appears in the *Times* from the pen of "M.Inst.C.E.," in which the writer very ably shows the disastrous effect that municipal trading and other schemes will undoubtedly have upon the future of electrical engineering enterprise and industry in this country. By the rejection of the General Powers Bill the House of Commons has struck a disastrous blow at British industry, and if other schemes when introduced or re-introduced are to be dealt with in the same summary manner, "one of the most promising openings for British trade will be almost closed." Cheap power and lighting current would be of untold value to many a small village which cannot afford to put down a municipal plant. Failing a supply from these large schemes, a number of the municipalities may put down a combined installation for the several places, but speaking with full knowledge of the electrical industry, the writer says that if this comes to pass it will be only after the waste of years and the waste of millions, and millions which might be invested at once with profit to the country as well as to the trade will never be invested at all. The British electrical industry will remain, as now, backward and undeveloped, and by this blow at the home trade the hope of foreign trade will be still further shattered. The prospect of "the greatest of modern industries" being given fair scope in England is wrecked by municipal jealousy.

Novel Reduction Gearing.—We have had brought to our notice an arrangement of epicyclic reduction gearing for driving electric motors or other machinery, which, as a means of reducing the speed from motors without the intervention of a countershaft, seems likely to meet the requirements of electric traction and transmission of power in a manner hitherto unheard of. Primarily invented and designed as a substitute for the back gearing of lathes, it has since been much extended in its applications. Messrs. J. C. Howell & Co., 24, Queen Victoria Street, will be pleased to show it to anyone interested, and we would strongly recommend electrical engineers engaged in the above-mentioned branches of the profession to closely investigate the gear for themselves.

CITY NOTES.

The British Electric Traction Company.

The statement made by Sir C. Rivers Wilson at the meeting of this company last Saturday, taken in conjunction with the details of the company's schemes as given in another column of this issue, form very interesting reading even for those who have not the good fortune to be shareholders. A celebrated divine declared the world to be his parish, and so far as the United Kingdom is concerned the British Electric Traction Company recognises no limitation to the sphere of its operations. To those who have watched week by week the progress of the negotiations which have been conducted with unremitting energy by the company's officials in a score or so of towns in the provinces, it is not surprising that new capital, even to the tune of £600,000 should be required to carry into effect the important concessions which have been obtained. The company is certainly to be congratulated upon the victories it has scored over reckless municipalisation proposals in several places. Some of its schemes it has failed to carry through, but the expenses incurred in these cases are, we doubt not, insignificant compared with the value of the concessions secured elsewhere. In its warfare against municipalisation, as Sir Charles showed, the company is leading to considerable developments in electric traction, which would not otherwise have happened. Municipal authorities, by deductive reasoning, argue that if a company expects to work electric tramways profitably the local authority might do so with equal success. The Chairman assured his shareholders that municipalities do not know how to go about the business. He referred to the evils of the policy of excessive municipalisation, and to the disastrous effects of the growing desire for municipal trading. If the hand of private enterprise is to be stayed, the United Kingdom will not experience the same healthy development in electric tramways and light railways that has been witnessed on the Continent and in America. The future of electric traction in this country and the success of the British Electric Traction Company are, so to speak, interdependent, and for the sake of the former we hope that the latter, having arrived at the dividend-paying stage, may reap larger profits from the actual operation of the many lines in which it holds an interest.

Held Over.

Pressure upon our space compels us to hold over until next week the directors' reports of the following:—County of London and Brush Provincial Electric Lighting Company, Richmond Electric Light and Power Company, and Willans & Robinson, also the meeting of the Dover Electricity Supply Company.

British Electric Traction Company, Limited.

Sir C. Rivers Wilson presided on Saturday at the offices, Donington House, Norfolk Street, Strand, over the third ordinary general meeting, and, in moving the adoption of the report, expressed a hope that they would agree with him that his prediction at their previous meeting had been realised, and that the balance-sheet now presented showed that the company was in a very strong position. The directors were able to show, at the end of the second year of the company's operations, the substantial net profits of £67,778, which included the sum of £9,804 brought forward, but not the premiums received on the new issue of capital. From the net profit they proposed to write off the balance of the preliminary expenses, £5,879. The goodwill account stood last year at £15,000, off which they proposed to write £5,000. They might remember how the goodwill account arose. At the inception of the company £5,000 was paid as profit to the shareholders in the Pioneer Company, the other £10,000 going for the promotion of the company. These were not excessive figures in view of the very valuable business which had been built on the foundations thus provided; in fact, it was absurd for the goodwill of such a company to be put at so low a figure, and the account ought to be written up instead of down. Nevertheless, the directors proposed gradually to extinguish this account. They had not only made what he thought every one would admit to be a satisfactory profit, but they had built up a great organisation, which would serve the purpose of creating and carrying on a large business in the future, and had laid the foundation for many profitable transactions. The whole expense of developing the business had however either been charged to revenue account or had in part been added to the cost of undertakings in hand, all of which would come back to them with a profit. After paying or providing for the dividend on the preference shares up to the end of last year, a balance of £53,451 remained. As the proposed dividend of 6 per cent. on the ordinary shares for the year would absorb only £18,000, some of them might think that the directors had erred on the side of prudence, and that they ought to distribute a larger dividend. The board had, however, given this matter their most anxious consideration. If they could be quite sure of the future there would be no objection whatever to making a somewhat larger distribution; but in view of the fact that they were developing a very large business, and one not altogether free from uncertainties, they thought it would be wiser for them to make it their first object to put the company in a thoroughly sound financial position, as by doing so they would obtain the best possible security for a continuance of profitable business and increased dividends. Moreover, as he had said before, the full development of their business required large increases of capital, and the stronger their position the better would be the terms upon which they could raise this capital. Furthermore, the charge for dividends in the past year was only £21,448, whereas on the capital now actually issued, without taking into consideration the charge which might arise in respect of future issues, the amount required for the dividend in the present year would be £46,000. Altogether, therefore, they had thought it well to carry forward the balance of £35,450. The whole of their share capital, and £200,000 of debenture stock, making £800,000 in all, had been issued up to date. At the end of 1898 only £500,000 had been issued, and the net amount of premiums received was £29,135, all of which had been invested in Consols; and since the close of the year premiums amounting to about £45,000 had been realised on the further issues of capital which had been made. They had, therefore, a reserve fund now of about £75,000, which the directors intended to invest in Consols and other first-class securities. Now that the whole of their share capital had been subscribed and was profitably employed, they thought it advisable to ask the share-

holders to empower them to make further issues as and when the directors might deem advisable. They certainly would not needlessly increase the capital, but it would be regrettable if they were not in a position to take up any good business that might be offered to them. The proposal they would submit to the extraordinary general meeting which would be held at the close of the ordinary meeting was to double the present share capital, and this would give the directors power to double the present issue of debenture stock also. This would certainly be sufficient to carry them on for the present. They had dealt with a large number of schemes during the short period of the company's existence, and there was, in fact, scarcely a division of the British Isles in which the company were not carrying on operations, some of them being of considerable magnitude. To take the Potteries Electric Traction Company as a sample, that company, which had a subscribed capital of £400,000, were carrying out electrical tramways and light railways extending over a distance of 34 miles. Having mentioned other undertakings in which their company were interested, he stated that an important point in connexion with all these separate concerns was that although for various legal and other reasons it was necessary to carry out the business by means of separate companies, yet most or all of these companies were under the control and management of their own company. This arrangement had the advantage of giving to those companies the benefit of the experience which the officers of their company had acquired in a large number of undertakings all over the country, and each company only bore its fair proportion of the total expenses. Another point was that their company retained a large interest in all these companies, the shareholders in which had a very good security, while this company would permanently have many sources of income. By far the largest part of the company's capital was invested in debentures and shares in associated and other companies, and when he stated that these investments covered a list of no fewer than forty companies, the shareholders would see that they had no cause to fear that they had all their eggs in one basket. He believed he was not mistaken in asserting that every one of their investments was a satisfactory source of profit, and they took care in making them to obtain an immediate minimum return. It was not, however, so much at present for the sake of investment that they put their money into these companies, but rather with a view to develop electric traction and the business of their company. They had in the first place to teach existing tramway companies that it was to their own interest to adopt electric traction, and when they had succeeded in doing this they had to approach the local authorities and persuade them to allow electric traction to be adopted. In each case they were met with some misgiving and suspicion, and in the case of the local authorities they were brought face to face with the difficulty caused by the present tendency of municipalities to undertake trading operations. Municipalities had not the enterprise or the initiative to propose electric tramways, but directly the company approached them with proposals to improve the service of the tramways in their towns or to provide additional tramway facilities it at once occurred to them that the company being a commercial body, would not make such proposals if they were not likely to be profitable, and then they wanted to know why, if a profit was to be made, they should not make it themselves. But the municipalities did not know how to go about the business. They did not, however, hesitate to negotiate with the company, and then when the latter had told them all they could they frequently decided in favour of a policy of what was called "municipalisation," on the ground that this was in the interests of the ratepayers. But the curious thing about the cry of municipalisation for the benefit of the ratepayers was that in most cases where corporations had thus municipalised commercial undertakings the rates did not go down, but, on the contrary, rose steadily. On a former occasion, when he addressed them on this subject, he referred to the difficulties which corporations had in municipalising tramways and light railways when worked by electricity, because these undertakings sometimes required to be carried beyond municipal boundaries; and the directors' further experience of these difficulties had convinced them that, if the development of this enterprise in this country was to be in the hands of local authorities, we should never have the tramway and light railway facilities which other countries possessed. He might say much more on this subject, but it would suffice on that occasion to tell them that the Government had realised some of the difficulties he had mentioned, and had decided to appoint a Select Committee of both Houses of Parliament to consider what should be the proper sphere and scope of municipal enterprise. He might add that the company did not propose to confine their operations entirely to these islands; they hoped to obtain a share in profitable undertakings in foreign countries, or, still more probably, in some of our colonies. There was no reason why they should not undertake this work if it were profitable; but he insisted on it, in connection with the question of the opposition they encountered from local authorities, as a sort of object lesson, showing how the policy of these bodies had a tendency to drive British enterprise and capital out of this country. The board proposed in future to make up the accounts of the company to the end of March each year. This change would enable them to include in their profit and loss account the results of the year's working by the various associated companies.

Mr. Emile Garcke seconded the motion.

A discussion followed, in which the principal point urged was that the shareholders should receive the first offer of taking up any fresh issues of capital that might be made by the company. Satisfaction was also expressed with the results of the year's working.

The Chairman, in answer to questions, stated that on appointing any of their officers or directors to act as administrators of companies which this company controlled no remuneration was allowed for their services. What ver fees were received from the other companies were paid into the treasury of this company. The motion was then unanimously adopted.

At the subsequent extraordinary general meeting the chairman proposed an increase of the capital from £600,000 to £1,200,000 by the creation of 60,000 new shares of £10 each—30,000 preferred and 30,000 ordinary. He referred to a notice of motion, which Mr. Makins had forwarded to the directors, to the effect that all new shares should be offered to the members in proportion to the existing shares held by them; and stated that it would be quite impossible for the board to accept such a resolution as a binding instruction. He, however, agreed that there was a great deal to be said for an occasional and, very likely, it might be, in certain circumstances, frequent adoption of the practice indicated by Mr. Makins.

Mr. Garcke seconded the resolution, after which Mr. Makins proposed as an amendment the motion referred to. He contended that what the chairman had said against it related to a period when the company was not in the strong position which it now occupied, and he maintained that there was no longer any necessity to resort to outside financial aid.

The amendment was duly seconded, but, after some further discussion, it was withdrawn by Mr. Makins, and the original motion was then adopted.

Direct Spanish Telegraph Company, Limited.

The Marquis of Tweeddale presided on Friday last at Winchester House over the 47th ordinary general meeting. In moving the adoption of the report, the chairman stated that the traffic receipts showed an increase of £3,812, owing almost entirely to the exceptional state of things which prevailed in the Spanish colonies during the past year. The traffic, however, has now fallen back to its normal state, and he might mention that the decline in the receipts up to date had been £891, although the number of telegrams had been very much greater. During the time of the Spanish war they had long official messages and very long Press messages, which went to swell their receipts. This had now all come to an end, and they would have to look forward to somewhat reduced receipts. Their ordinary expenses exhibited an increase of £349 consequent on the increased traffic, but there had been a decrease of £153 in the London office and station expenses, and of £33 in the travelling expenses. The extraordinary expenditure was higher than it was in 1897 owing to the cost, £2,117, of the two repairs to the Bilbao cable, and to the extension and alteration of the London station, which cost £961. Excellent accommodation had now been provided by the acquisition of a long lease of No. 75, Gracechurch Street, which would enable them to carry on their business with greater advantage to the public and with greater comfort to the staff. The terms on which the parts of the building not required by the company had been let would make the rent paid by them extremely reasonable. The item of £386 on the debit side of the revenue account was for the cost of renewing the two submarine cables across the Helford river, which formed part of the duplicate underground line between Falmouth and Kennack, where the Bilbao cable landed, and which after working for 17 years, entirely failed during last year. The item in the extraordinary expenses which showed the largest increase, £498, was explained by the necessity of renewing the underground lines at Bilbao. Their station in that town was connected with Arrigunaga, the landing place of the cable to England, by underground cables. These were laid in 1882, and in many places had become very defective owing to the nature of the soil and other causes. It was therefore decided to replace the worst sections, before the cables failed entirely, by pipe lines. This important connexion was now in fairly good order, although it was not at all improbable that before very long they might have to renew further sections of these underground cables. They had also expended £118 on supplying and fitting Hughes' instruments at their Bilbao station, the Spanish Telegraph Administration having urged the adoption of these instruments in working the special wire between Bilbao and Madrid, the communication between which had thus been considerably improved. The Morse instruments could, however, be resorted to at any time on the Madrid-Bilbao wire when through communication between Madrid and London was required. In May of last year a fault was discovered in the Bilbao cable about 13 miles from Bilbao. It was not serious enough to interrupt communication, but it rendered duplex working difficult, and as a repairing ship of the Eastern Telegraph Company happened to be on her way from Lisbon to England, the opportunity was taken advantage of to remove the fault. Two months later the Bilbao cable gave way altogether, at 199 knots from Falmouth, owing to the cable lying upon uneven ground. This repair was remarkable for the promptitude with which it was effected. The break occurred on July 8th, and, although the steamship *Mirror* was then in the Thames, the repair was effected within six days—a fact which reflected considerable credit on Captain Pattison. After providing for the debenture interest and redemption and transferring £5,000 to the reserve fund, they were able to recommend the dividend of 10 per cent. on the preference shares, less income tax, and a dividend at the rate of 4 per cent. on the ordinary shares, tax free. The reserve fund now amounted to a little over

£50,000, which was a substantial sum, no doubt, but which the directors thought was still not adequate as a provision for future contingencies. The only criticism which had reached them with reference to the report was that the dividend was not quite as large as might have been expected; but he thought that what he had said about the decline in their traffic receipts this year and their return to a normal condition afforded very good reason for not increasing the present dividend. If they could have done so, and have felt that the improvement could be maintained, they would have had no hesitation in recommending the payment of a somewhat larger dividend. They felt in the circumstances that it was better to strengthen their finances by adding to the reserve fund.

Mr. J. Denison Pender seconded the motion, which was carried unanimously.

The Hiram S. Maxim Electrical Corporation, Limited.

The first ordinary general meeting of the shareholders of this company was held on Thursday, March 16th, at the office, 15, George Street, Mansion House, Mr. Wynardus Devenish presiding.

The Chairman having made a brief opening speech called upon Mr. Hiram S. Maxim, the managing director, who said that although the work they had done so far was little more than on a laboratory scale, still he thought they might congratulate themselves on the progress they had made during the last few months. They had made it a part of their business to purchase and test all forms of incandescent lamps made in this country and abroad, and they found that instead of these lamps taking 3 watts per candle-power, as was generally supposed, the greater part of them required between 4 and 5, and many of them between 5 and 6, and all the lamps of supposed high efficiency by foreign makers that they had tested so far had a very short life-time, many of them going out after a few hours' service. Their experiments had demonstrated that they could make lamps of a considerable higher efficiency than those now in the market, and those lamps were by no means short-lived. What he proposed to do at their new works was to produce lamps of the highest possible quality, the best lamps that modern civilisation could produce. He did not propose to allow any inferior work to leave the place; he wished to have it said in the trade that in purchasing lamps from the corporation, although the price might be slightly more than the cheap foreign stuff, it insured getting the very best in the world. He thought they should congratulate themselves on having obtained very large and excellent premises in the very heart of London—he referred to their new place in Gillingham Street, Victoria. These premises were so extensive that they would be able to produce large quantities of lamps, and as they intended to make various kinds of ornamental lamps to order, architects and decorators would, they thought, find it to their advantage to patronise their place because, no matter what sort or kind of lamp was required, it could be produced and delivered in London at a few hours' notice. They also intended to take up other electrical inventions. He had recently taken a patent on a device which he thought would be of great utility on electrical railways, and those most certainly would come into use in England at no distant date. He had spent considerable time during the past year in the United States of America, where he had made a point of inquiring into the progress which had been made in that country relating to electricity, and he was assured by one of his old associates that since 1880 no less than four thousand millions of dollars had been spent in the United States of America on electrical plant. In regard to the new Nernst lamp which had recently made its appearance, he did not believe that they need fear any competition from that direction. The incandescent lamp of to-day was the light "de luxe," it was convenient and simple. The new Nernst lamp did not lend itself kindly to the requirements of domestic lighting, and the slight advantages that it might possess in point of economy were not great enough to compensate for the many disadvantages inherent to the system. In conclusion, he would say that he felt very confident that they would be able to secure a large share of the electric lamp making business in England and at such prices as would ensure their paying their shareholders a handsome dividend.

In reply to a question Mr. Maxim said he could not state exactly when they would get possession of their premises, but he should think that in all probability they would commence the manufacture of lamps in about three months' time.

A vote of thanks to the chairman concluded the proceedings.

Pontypool Electric Light and Power Company.

The seventh annual report states that the directors have expended a further sum of £518 6s. 10d. in free-wiring, which has yielded a most satisfactory return, the additional customers thus brought in having put the company on a good profit-earning basis. The directors, however, have thought it best to give notice that they would discontinue their free-wiring system at the end of the year 1898, in order that they may consider their position. During the year, the building of the station has been extended so as to include the whole of the ground taken by the company from the ground landlord, and a new boiler and steam dynamo have been erected therein, approximately doubling the capacity of the station. This entailed an extension to the mains so as to provide for the additional number of lamps likely to be added to the system. To meet this capital expenditure, the directors have made a fresh issue of debentures amounting to £5,000, out of which they have paid off the previous issues, which amounted to £2,000. The new issue is at the rate of 4 per cent. per annum; however, there is still a balance to the debit of capital account amounting to £166 19s. 5d. The running of the station for the year ending December 31st, after carrying a sum of £100 to renewal account, has resulted in a net profit, which, with the balance carried forward from last year, amounts to £475 5s. 2d. Of this a sum of £50 has been carried to the reserve account, £150 has been carried to an account to be formed for redemption of debentures, and that a dividend of 5 per cent. has been declared upon the paid-up capital of the company, leaving a balance of £13 4s. 2d. to be carried forward to next year.

South London Electric Supply Corporation, Limited.

The ordinary general meeting of shareholders of the above company was held on Tuesday, at Winchester House, Old Broad-Street, Mr. George Ellis, J.P., presiding.

The Chairman, in moving the adoption of the report, said they met the shareholders with the utmost confidence, as he felt that their financial policy had proved to have been based on thoroughly sound business principles, and had consequently been of immense advantage to the company. Now that they had had time to realise the magnitude of the work they had undertaken, and the possibilities of the demand for electric energy in the parish of Lambeth, entailing miles and miles of mains, and the great outlay necessary for the erection and equipment of so large a combined generating station and dust destructor as they were building, the largest he believed in the United Kingdom, he thought they had reason to congratulate themselves upon their strong financial position. As to the buildings, they would recollect that owing to difficulties and negotiations in connection with the acquisition of site, it was not until the Michaelmas of 1897 that they were able to obtain possession of the land, so that, what with the time taken up in getting building materials on it and organising the labour, it was not until November, 1897, that the contractors were able to commence the actual construction of the buildings. The position to-day was that the chimney shaft, 180 feet in height, was quite complete and ready for use. The main building, consisting of the destructor house, boiler house, engine and dynamo house, was finished and roofed in, and the various rooms adjoining the main building, consisting of coal and other stores, outbuildings, &c., were also finished. The whole of the boilers had been delivered and erected, and four of the boilers and eight of the destructor cells were finished and ready for use; whilst the progress being made on the remainder made it certain that the whole of the work within the destructor and boiler house would be finished by the early summer. The artesian well was finished, and would supply ample water for all their needs. As to the mains, &c., he was pleased to say that the progress made by the British Insulated Wire Company in the laying of mains during the past year had been most satisfactory. Mains have now been laid in a total of over 22 miles of streets. Earthenware conduits to carry H.T. cables had been laid for sufficient length to carry over 44 miles of H.T. cable. 24 miles of L.T. distribution cable had been laid on the solid filling in system and brought into use; and over 13 miles of H.T. feeders had also been drawn in the before mentioned ducts and brought into use. From these mains 220 connections to consumers' houses had already been run, and of course meters erected and connected up in each case. They had been taking on consumers and supplying them with energy by means of connecting their mains to those of a company who had a generating station in a district adjoining theirs. Of course that had not been done without incurring some additional expense, but they considered that they were amply compensated for the cost involved, for they had by that means been enabled to take on consumers with a total number of 15,870 8-c.p. lamps already, which would enable them to employ their machines directly they were ready, and thus avoid the great loss which generally occurred after the opening of an electric light station while waiting for customers to get their premises wired. That should be most satisfactory to the shareholders, as if such a large number of consumers could be obtained before the station was opened, there must be every prospect of a large and lucrative business in store for them.

Mr. W. W. Phipps seconded the resolution, and after a short discussion of a congratulatory character, the report was adopted.

The report of the directors of the South London Electric Supply Corporation, Limited, for the year 1898, states that good progress has been made in developing the undertaking. The buildings comprising the dust destructor, engine house, coal stores and workshops are nearly completed. The boilers are already in position, whilst the necessary steam pipes, electrical plant, storage batteries, engines and steam alternators are in course of construction, and should be delivered in a few weeks. Permanent offices have been erected at the works in which the staff of the commercial and technical departments will be concentrated. The present temporary offices in Victoria Street, Westminster, will be vacated on 25th inst. The directors having decided upon sinking an artesian well at the corporation's site, the result has been most satisfactory, the engineers reporting a test showing that at least 5,000 gallons of excellent water per hour can be depended upon. The total cost of boring and equipping the well will amount to less than £1,000. This will save a considerable annual expenditure for water. The work of laying the mains has proceeded with great rapidity.

The length of roadway in which mains have been laid now reaches 22 miles, making about 68 miles of ways, into which upwards of 37 miles of cable have been drawn. In pursuance of the policy alluded to in their last report, the directors have been able to supply electricity to a large number of lamps, pending the construction of the generating station, by connecting the corporation's mains to those of the County of London and Brush Provincial Electric Lighting Company, Limited, whose supply has at all times been most efficient. It must be borne in mind that this policy has been adopted with the view of forming the nucleus of a business, and not in the expectation of earning immediate profit. When the works are opened, the lamps of the numerous consumers already connected will at once provide a load for the machines, there being at this date on circuit the equivalent of upwards of 15,000 8-C.P. lamps, with applications in hand for a further 2,500. As the undertaking is still in its constructional stage, the accounts cannot yet be drawn up in the Board of Trade form. A revenue account is appended, the balance of which has been carried into the general balance-sheet.

Evered & Co., Limited.

The directors submit the balance-sheet, showing, after providing for debenture interest, amounting to £2,416 13s. 4d., a net profit of £25,698 16s. 6d., making, with £6,361 11s. 8d. brought forward from 1897, the sum of ... ... £32,060 8 2 to be dealt with.

	£	s.	d.
An interim dividend at the rate of 7½ per cent. per annum, to June 30th, 1898, has been paid, absorbing	6,402	18	0
And your directors propose			
To pay a dividend at the rate of 7½ per cent. per annum for the remaining six months, which will absorb	6,402	18	0
„ Pay a bonus of 2½ per cent. per annum for the year	4,268	12	0
„ Write off plant	2,000	0	0
„ „ goodwill (entirely clearing it) ...	4,000	0	0
„ „ buildings	1,000	0	0
„ Place to an equalisation of dividends account...	1,000	0	0
„ Carry forward to next account	6,986	0	2
	£32,060	8	2

In presenting the above report, which the directors consider most satisfactory, they have pleasure in stating that the business continues to make good progress, and the number of customers to increase. The works are fully employed in all departments, despite higher prices and ever-increasing competition. The stocks of copper and other raw material have been taken at prices ruling in 1897.

Oxford Electric Company, Limited.

The ordinary general meeting of this company was held last Friday afternoon, Sir Henry C. Mance, presiding.

The Chairman said they had practically doubled the conducting capacity and materially increased the efficiency of the system, which was now 72 per cent. as compared with 65 per cent. during 1897. As explained in his last speech, they had started installations on the hire-purchase system, and their capital expenditure on this account was a little over £900, and they had found the system work very well indeed. The total capital expenditure for the year was about £6,900, which, as stated in the report, had been provided for by the issue from time to time of debenture stock as required. The cost of generating had slightly decreased, and the results would have been still better but for the fact of the coal strike, which compelled them to use fuel of inferior quality and higher price. On the whole, the management expenses were less, and the total costs work out at 2·99d. per unit sold, as against 3·19d. in 1897. That showed, he thought, a satisfactory decrease in the figures. The revenue, he was sorry to say, had not been proportionate to the increase in the number of lamps, but it was not difficult, he thought, to account for that. Not only was there more economy practised by people substituting small lamps where large ones were not necessary, but it had been a rather unfavourable season, and this was not the only electric light company whose receipts were prejudicially affected from this cause. The new sub-station in Ship Street, from which now radiated the high tension mains to all the sub-stations, was now fully equipped, and would also accommodate a portion of their storage battery. The change of the method of distribution had been carried out by the engineers of the staff without any interruption to the public or private service. The annual report would inform them in what direction they had been extending their mains, and they were prepared to extend them still further when they received any reasonable application. Their price was still 7d., but he knew the directors would always consider the desirability of making the supply of current as cheap as they could, consistent with justice to the shareholders. Personally, he had a strong belief that they would ultimately get electricity nearly as cheap as gas. He did not say the company would have to come down much in its price, but the tendency of the age was to discover lamps of higher efficiency than there were at the present time, and rumours were in the air that before long they would be sold in this country. It did not follow that was at all a bad thing for the company, because if they could supply to the customers with their present plant what would probably mean double the consumption of electricity, it came the same thing to the company. They wanted to make the light as popular as possible, and to make it what it was hoped it would be, the poor man's light. The report was then adopted.

New Issue.

Davis & Timmins, Limited, has been formed with a capital of £110,000, divided into 60,000 6 per cent. cumulative preference shares of £1 each and 50,000 ordinary shares of £1 each, to acquire and further extend the well-known business of Messrs. Davis & Timmins, screw manufacturers and metal merchants. The profits for the past three years have averaged annually £9,523, which, after providing the interest on the preference shares, directors' fees, and management remuneration, would on the present basis yield a substantial dividend on the ordinary shares. Mr. Emile Davis, the founder of the business, has entered into an agreement, undertaking to continue to act as managing director of the company for life, or as long as his health will permit. Mr. A. Le Neve Foster and Mr. G. E. Davis, who have assisted in the management of the business, have also agreed to continue their services as heretofore for a period of seven years. Mr. Emile Davis and Mr. A. Le Neve Foster, who will act as directors, are interested in the sale to the company, and they stipulate that they shall receive a minimum allotment of 16,666 ordinary shares. The purchase price payable by the company has been fixed at £87,000, payable as to £40,000 in cash, and as to the remaining £47,000, either in cash or in ordinary shares, or partly in one and partly in the other, at the option of the directors. Of this amount £20,000 is retained by the vendors, out of which they agree to pay all preliminary and promotion expenses up to the first allotment of shares, including underwriting and brokerage. Out of this issue an additional £23,000 is set aside for providing funds for the acquisition and equipment of the new factory, and for further working capital, which, with the stock of metal valued at upwards of £5,000, is considered ample for all purposes. The new company will undoubtedly acquire a first-rate business, and ought to prove a profitable investment.

Stock Exchange Notices.—Applications has been made to appoint a special settling day in British Insulated Wire Company, Limited—5,530 vendors' 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 1 to 5,530, and a further issue of 7,500 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 20,001 to 27,500; and to allow the following to be quoted in the official list:—New General Traction Company, Limited—24,000 ordinary shares of £5 each, fully paid, Nos. 10,001 to 34,000.

Robey & Co., Limited.—The report for 1898 states that, after writing off £6,080 for depreciation, the net profit was £30,563. After deducting debenture interest, and adding £770 brought forward, there is a balance of £24,147 available for division. The directors recommend a dividend of 10s. per share, and the adding of £10,000 to the reserve, carrying forward £352. The directors have resolved to pay off during the present year the whole of the second issue of debentures, amounting to £46,305.

Anglo-American Telegraph Company, Limited.—The directors have resolved, after placing £6,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending March 31st, 1899, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on May 1st, to the stockholders registered on the books of the company on March 31st, 1899.

Eastern Telegraph Company, Limited.—An interim dividend of 1¼ per cent. on the ordinary stock, tax free, for the quarter ended December 31st, is announced.

Aron Electricity Meter, Limited.—An interim dividend at the rate of 6 per cent. per annum on the preference shares will be paid on April 1st.

TRAFFIC RECEIPTS.

The Blackpool and Fleetwood Tramroad Company.—The receipts for the week ending March 18th, 1899, were £236 9s. 6d.; aggregate to date, £1,912 17s. 11d.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending March 17th, 1899, were £2,709 16s.; corresponding period, 1898, £2,503 3s. 4d.; increase, £206 12s. 8d.

The City and South London Railway Company.—The receipts for the week ending March 19th, 1899, were £1,099; week ending March 20th, 1898, £1,030; increase, £69; total receipts for half-year, 1899, £13,278; corresponding period, 1898, £12,826; increase, £452. Miles open, 3¼.

The Dover Corporation Electric Tramways.—The receipts for the week ending March 18th, 1899, were £141 18s. 5d.; week ending March 19th, 1898, £117 17s. 5d.; increase, £24 1s. Total receipts to date, 1899, £1,571 19s. 8d.; corresponding period, 1898, £1,166 8s. 11d.; increase, £405 10s. 9d. Miles of track open week ending March 18th, 1899, 3; week ending March 19th, 1898, 3. Car miles run week ending March 18th, 1899, 4,355; week ending March 19th, 1898, 3,139. Number of cars, week ending March 18th, 1899, 11; week ending March 19th, 1898, 7.

The Dublin United Tramways Company.—The receipts for the week ending Friday, March 17th, 1899, were as follows:—D. U. T. Co., horse cars, £1,769 1s. 3d.; ditto, electric cars, £1,039 3s. 6d.; D. S. D. Co., electric cars, £733 6s. 1d.; total, £3,541 10s. 10d.; corresponding week last year—D. U. T. Co., horse cars, £2,516 13s. 10d.; ditto, electric cars, £124 17s. 1d.; D. S. D. Co., electric cars, £402 17s. 9d.; total, £3,044 8s. 8d.; increase, £497 2s. 2d.; aggregate to date, £35,265 11s. 9d.; ditto last year, £33,246 9s. 5d.; increase to date, £2,019 2s. 4d. Worked:—The mileage open is 18 miles electrically, 26 miles by horses, as against 11 miles electrically, and 31 miles by horses, for the corresponding period last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending March 19th, 1899, amounted to £1,369; corresponding week last year, £1,316; increase, £53.

The South Staffordshire Tramways Company.—The receipts for week ending March 17th, 1899, were £615 14s. 6d.; aggregate receipts for 11 weeks, £6,550 0s. 1d.; week ending March 18th, 1898, £552 9s. 5d.; aggregate receipts for 11 weeks, £6,341 19s. 9d.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1896.	1897.	1898.	Closing Quotation, March 15th.	Closing Quotation, March 22nd.	Business done during week ended March 22nd, 1899. Highest.	Lowest.
124,400£	African Direct Telegraph, 4 % Debs.	100	...	...	...	100 —104	100 —104	...	...
25,000	Amazon Telegraph, shares	10	...	...	...	3 — 4	3 — 4	...	...
125,000	Do. do. 5 % Debs. Red.	100	...	...	...	87 — 92	87 — 92	...	...
905,560£	Anglo-American Telegraph	Stock	£2 13s	3 %	£3 9s	65 — 68	65 — 68	...	...
3,047,220£	Do. do. 6 % Pref.	Stock	£5 6s	6 %	6 %	116½—117½	116½—117½	117	116⅝
3,047,220£	Do. do. Deferred...	Stock	...	...	18s. %	13¾— 14¼	13¾— 14¼	14 3/16	14
130,000	Brazilian Submarine Telegraph	10	7 %	7 %	...	16 — 16½	16 — 16½	16 5/16	16 1/16
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	110 —114	110 —114	...	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	4 %	...	2¾— 3¼	2½— 3	...	...
10,000,000$	Commercial Cable	$100	8 %	8 %	...	190 —200	190 —200	...	...
1,332,523£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	105 —107	105 —107	106⅝	106⅛
224,850	Consolidated Telephone Construction and Manufacturing	10/-	2 %	...	...	1/16 — 3/16	1/16 — 3/16	...	...
16,000	Cuba Telegraph	10	8 %	7 %	...	9½— 10½	9 — 10	9⅞	...
6,000	Do. 10 % Pref.	10	10 %	10 %	...	17½— 18½	17½— 18½	17½	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	...	10 — 11	10 — 11	...	...
30,000£	Do. do. 4½ % Debs., Nos. 1 to 6,000 ...	50	4½ %	4½ %	...	104 —107%	106 —109	...	...
60,710£	Direct United States Cable	20	2½ %	...	...	12½— 12¾	12½— 12¾	12 7/16	12¼
120,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	103 —106	103 —106	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	...	...	...	180 —185	180 —185	181½	180
1,795,000	Do. 3½% Pref. Stock	100	...	...	...	104 —107	103 —106	105¼	103
89,900	Do. 5 % Debs., repayable August, 1899 ...	100	5 %	5 %	...	99 —102	99 —102	...	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	...	125 —129	125 —129	125½	...
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	...	18 — 18½	18 — 18½	18¼	18
16,200£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	5 %	...	99 —103	99 —103	...	...
64,400£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	5 %	...	100 —103	100 —103	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	...	125 —129	125 —129	125	...
35,100£	Eastern and South African Telegraph, 5 % Mort. Deb., 1900 red. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	...	...	99 —103	99 —103	...	...
46,500£	Do. do. to bearer, 2,344 to 5,500	100	5 %	...	...	100 —103	100 —103	...	...
300,000£	Do. 4 % Mort. Debs., Nos. 1 to 3,000, red. 1909	100	4 %	...	...	102 —105	102 —105	...	...
200,000£	Do. 4% Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	4 %	...	...	104 —107%	104 —107%	...	...
180,227	Globe Telegraph and Trust	10	4½ %	4½ %	...	12¾— 13¼	12¾— 13¼	13⅛	12⅞
180,042	Do. do. 6 % Pref.	10	6 %	6 %	...	16¾— 17¼	16¾— 17¼	17⅛	16 3/8
150,000	Great Northern Telegraph, of Copenhagen...	10	10 %	10 %	...	30 — 31	30 — 31	30	...
97,800	Halifax and Bermuda Cable, 4½% 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	100 —103	100 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	...	57 — 60	57 — 60	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs. ...	100	6 %	6 %	...	108 —111	108 —111	...	...
484,597	National Telephone, 1 to 484,597	5	5½ %	6 %	6 %	4¾— 5¼	4½— 5	4 7/8	4
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	12½	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	13⅜	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	5	4 7/8
1,329,471£	Do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	99 —101	99 —101	100¼	99
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	...	1/16 — 1/8	⅞— 1	1 1/16	⅞
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	4 %	4 %	...	105 —108	105 —108	...	...
11,839	Reuter's	8	5 %	5 %	...	6½— 7½	6½— 7½	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	140 —145	140 —145	...	...
58,000	United River Plate Telephone	5	5 %	6 %	...	4¾— 5¼	4¾— 5¼	...	...
151,738£	Do. do. 5 % Debs.	Stock	...	...	...	104 —107	104 —107	...	...
200,000£	West African Telegraph, 5 % Debs.	100	5 %	5 %	...	99 —102	99 —102	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	½— 1	½— 1	...	...
150,000	Do. do. 4% Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	103 —106	103 —106	104	...
389,521	Western and Brazilian Telegraph 4 % Deb. Stock Red. ...	Stock	...	...	...	107 —110	106 —109	107	...
88,321	West India and Panama Telegraph	10	1 %	¾%	...	1⅞— 2⅛	1⅞— 2⅛	2	1 5/16
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	6 %	6 %	...	10½— 11	10½— 11	10⅞	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	6 %	6 %	...	9 — 10	9 — 10	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	...	105 —108	105 —108	...	...
158,100£	Western Union of U.S. Telegraph, 6 % Ster. Bonds ...	100	6 %	6 %	...	100 —105	100 —103	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electricity Supply	5	6 %	7 %	8 %	11½— 12¼xd	11½— 12¼xd	12	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	6 — 6¼xd	6 — 6¼xd	...	...
34,000	*Chelsea Electricity Supply, Ord., ...	5	5 %	6 %	6 %	8 — 9 xd	8 — 9	8½	...
60,000	Do. do. do. % Deb. Stock Red....	Stock	4½ %	4½ %	...	114 —116	114 —116	...	...
50,000	City of London Electric Lighting, Ord. 40,001—90,000 ...	10	7 %	10 %	6 %	18 — 19 xd	18 — 19	18⅜	18
10,000	Do. Ord. Nos. 90,001 to 100,000	10	...	...	...	18 — 19 xd	18 — 19	...	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	15 — 16 xd	15 — 16	15¼	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	...	124 —129	124 —129	...	...
30,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—30,000	10	*nil*	*nil*	*nil*	11½— 12½	11 — 12	11⅝	10½
10,000	Do. do. do. Nos. 30,001 to 40,000	10	...	...	...	11½— 12½	11 — 12	10½	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	14½— 15½	14 — 15	14 11/16	...
17,400	Edmundsons Elec. Corp., Ord. Shares 1—17,400	5	...	5 %	...	5¼— 5⅝	5¼— 5⅝	...	...
15,661	House-to-House Electric Light Supply, Ord., 101 to 15,761	5	...	4 %	6 %	8½— 9½xd	8½— 9½	...	...
12,000	Do. do. 7 % Cum. Pref. ...	5	7 %	7 %	...	9 — 10 xd	9 — 10	9⅜	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	3¾— 4	3¾— 4	...	...
48,050	Do. do. do. 6 % Pref.	5	...	...	6 %	6½— 7 xd	6½— 7 xd	6 1/16	...
100,000	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	105 —107	105 —107	106½	...
62,500	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	5 %	16 — 17	16 — 17	16⅜	16 1/16
22,500	Do. Nos. 62,501 to 85,000, £7 paid ...	10	...	...	...	12 — 13	12 — 13	...	...
220,000£	Do. 4½ % First Mortgage Debenture Stock	...	4½ %	4½ %	...	117 —120	117 —120	117¾	117
6,452	Notting Hill Electric Lighting	10	4 %	6 %	6 %	16½— 17½xd	16½— 17½	...	...
31,980	St. James's and Pall Mall Electric Light, Ord.	5	10½ %	14½ %	14½ %	16¼— 17½	17 — 17½	17½	17
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9 — 10	9 — 10	...	...
65,000	South London Electricity Supply, Ord., £3 paid	5	...	...	...	3½— 3½	3⅝— 3⅝	3 1/4	3½
79,900	Westminster Electric Supply, Ord., 101 to 80,000 ...	5	9 %	12 %	12 %	15½— 16	15½— 16	15¾	15 5/16

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid. § Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1896.	1897.	1898.	Closing Quotation Mar. 15th.	Closing Quotation Mar. 22nd.	Business done during week ended Mar. 22nd, 1899. Highest	Lowest.
60,000	Aluminium "A" shares, Nos. 1—60,000	1	...	...	...	3 — 3½	3 — 3½	...	...
90,000	Do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	94 —100	94 —100	...	...
30,000	British Electric Traction	10	...	...	...	21 — 22	19½— 20	21⅛	19¼
10,000	Do. do. 6 % Cum. Pref. 30,001—40,000 (issued at £2 10s. prem. all pd.)	10	...	...	...	13¾— 14¼	13¾— 14¼	14 1/16	13¾
100,000	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	126 —129	126 —129	128	127
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	3	*nil*	*nil*	...	2 — 2¼	1⅞— 2⅛	2 3/16	2 1/16
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	*nil*	4 %	...	2⅛— 2⅜	2⅛— 2⅜	2 5/16	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ...	Stock	...	...	...	110 —114	110 —114	...	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red. ...	Stock	...	...	...	101 —104	102 —105	...	...
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	...	...	...	12½— 13½	12½— 13½	13¼	13
90,000	Do. do 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	114 —117	114 —117	...	...
35,250	Central London Railway, Ord. Shares	10	...	...	...	9⅜— 10¼	9⅜— 10¼	10	...
178,303	Do. do. do. £8 paid	10	...	...	...	7¾— 8¼	7¾— 8¼	...	...
61,033	Do. do. Pref. half-shares £3 paid ...	...	...	...	...	3½— 4	3½— 4	...	...
71,447	Do. do. Def. do. £5 paid ...	...	...	...	...	4½— 4⅜	4½— 4⅜	...	...
630,000*l*	City and South London Railway	Stock	1 1/16 %	1⅞%	2⅛%	68 — 70	68 — 70	69	...
22,500	Do. do. Ord. shares, Nos. 1 to 22,500 £5 pd.	10	...	...	...	4⅜— 5½	4⅜— 5½	...	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	...	...	3¼— 3⅜	3¼— 3⅜	3⅝	...
82,850	Do. 5% 1st Mort. Reg. Debs., 1 to 743 of £100, and 901 to 1,070 of £50 Red.	...	...	...	...	98 —101	98 — 101	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	5½%	6 %	...	2½— 2⅜	2½— 2⅜	2½	...
17,139	Do. do. do. "A" Shares, 01—017,139	5	5½%	6 %	...	4 — 5	4 — 5	..	...
194,023	Do. do. do. 4 % Deb. Stock Red. ...	100	...	...	...	97 — 99	97 — 99	98	97¼
112,100	Electric Construction, 1 to 112,100	2	5 %	6 %	6 %	2½— 2⅜	2½— 2⅜	2⅜	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000 ...	2	7 %	7 %	7 %	3 — 3½	3 — 3½	...	...
140,300	Do. do. 4% Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	103 —106	103 —106	...	...
91,196	Elmore's Patent Copper Depositing, 1 to 70,000	2	...	...	...	⅝— ⅞	⅝— ⅞	...	...
67,275	Elmore's Wire Manufacturing, 1 to 69,385, issued at 1 pm.	2	...	...	...	⅝— ⅞	⅝— ⅞	...	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	7 %	...	10 — 12	10 — 12	...	...
12,500	Henley's (W. T.) Telegraph Works, Ord.	10	10 %	12 %	14 %	26 — 27	26 — 27	26⅜	26
3,000	Do. do. do. 7 % Pref.	10	7 %	7 %	7 %	18½— 19½xd	18½— 19½xd	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½%	4½%	...	112 —115 xd	112 —115 xd	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	10 %	22 — 23	21½— 22½	22⅝	22
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	102 —106	102 —106	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	2½%	3½%	3½%	9 15/16—10 1/16	10 — 10½	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	14⅜— 14⅞	14⅝— 14⅞	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	38 — 42 xd	38 — 42	39½	38½
150,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	104 —107	104 —107	105¼	...
13,400	Telegraph Manufacturing, Ord. Nos. 6,601 to 20,000 ...	5	...	...	...	10 — 10½	9¾— 10¼	10¼	10 1/16
13,400	Do. do. 5% Cm. Prf. Nos. 6,601 to 20,000	5	...	...	...	5⅞— 6¼	5⅞— 6¼	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	..	3 %	109 —112	109 —112	110½	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 10¼.
British Aluminium, Ordinary, 10½—11½; 7 % Pref., 12—13.
House-to-House, 4½% Debentures of £100, 104—107.
Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 12⅝—13⅛; 1st Preference Cumulative 6%, £5 (fully paid), 7¾—8¼. Debentures, 107—110. Dividend, 1898, on Ordinary Shares 10%.
National Electric Free Wiring, 10s. paid, ⅜—½.
Smithfield Market Electric, 3½—4½.
*T. Parker, £10 (fully paid), 15¾.

* From Birmingham Share List.

Bank rate of discount 3 per cent. (February 2nd, 1899).

MARKET QUOTATIONS, Wednesday, March 22nd.

CHEMICALS, &c.	Last week.	This week.	Increase or Decrease.
a Acid, Hydrochloric .. .. per cwt.	5/-	5/-	..
a „ Nitric .. .. .. per cwt.	29/-	29/-	..
a „ Oxalic .. .. .. per cwt.	32/-	32/-	..
a „ Sulphuric .. .. .. per cwt.	5/6	5/6	..
a Ammoniac, Sal .. .. .. per cwt.	37/-	37/-	..
a Ammonia, Muriate (grey) .. per ton	£19	£19	..
a „ „ (white) .. per ton	£26	£26	..
a Bleaching powder .. .. per ton	£5 15	£5 15	..
a Bisulphide of Carbon .. .. per ton	£15	£15	..
a Borax .. .. per ton	£16 10	£16 10	..
a Benzole (90 %) .. .. .. per gal.	7/-	7/-	..
a „ (50/90 %) .. .. per gal.	5/6	5/6	..
a Copper Sulphate .. .. .. per ton	£25 10	£25 10	..
a Lead, Nitrate .. .. .. per ton	£23 10	£23 10	..
a „ White Sugar .. .. .. per ton	£30 10	£30 10	..
a „ Peroxide .. .. .. per ton	£27 10	£27 10	..
a Methylated Spirit .. .. per gal.	2/9	2/9	..
a Naphtha, Solvent (90 % at 160° C.) .. .. per gal.	5/6	5/6	..
a Potash, Bichromate, in casks.. per lb.	3¾d.	3¾d.	..
a „ Caustic (75/80 %) .. per ton	£24	£24	..
a „ Bisulphate .. .. per ton	£35	£35	..
a Shellac .. .. per cwt.	67/-	67/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 15	£6 15	..
a „ Recovered .. .. per ton	£5 15	£5 15	..
a „ Lump .. .. .. per ton	£5 5	£5 5	..
a Soda, Caustic (white 70 %) .. per ton	£7 10	£7 10	..
a „ Crystals .. .. .. per ton	£3	£3	..
a „ Bichromate, casks .. per lb.	3d.	3d.	..
METALS, &c.			
b Aluminium Wire, in ton lots .. per ton	£224	£224	..
b „ Sheet, in ton lots.. per ton	£191	£191	..
p Babbitt's metal ingots .. .. per ton	£65 to £130	£65 to £130	..
c Brass (rolled metal 2' to 12') basis per lb.	8½d.	8½d.	..
c „ Tube (brazed) .. .. per lb.	10d.	10d.	..
„ Wire, basis .. .. per lb.	8½d.	8½d.	..

METALS, &c. (*continued*).	This week.	Last week.	Increase or Decrease.
f Ebonite Rod .. .. .. per lb.	8/-	8/-	..
f „ Sheet .. .. .. per lb.	5/-	5/-	..
g Copper Bars .. .. .. per ton	£77	£79	£2 dec.
g „ Wire (basis price) .. per lb.	9¾d.	9¾d.	..
g „ Sheet .. .. .. per ton	£77	£79	£2 dec.
g „ Rod .. .. .. per ton	£77	£79	£2 dec.
n German Silver Wire .. .. per lb.	1/6	1/6	..
h Gutta-percha, fine .. .. per lb.	6/-	6/-	..
h India-rubber, Para fine .. per lb.	4/4	4/4½	½d. dec.
i Iron, Charcoal Sheets .. .. per ton	£18	£18	..
i „ Pig (Cleveland warrants) per ton	48/2	47/1	1/1 inc.
i „ Forgings, according to size per ton	From £11	From £11	..
i „ Scrap, heavy .. .. per ton	50/- to 55/-	50/- to 55/-	..
i „ Wire galvanised No. 8 .. per ton	£9 5	£9 5	..
g Lead, English Ingot .. .. per ton	£14 15	£15	5/- dec.
g „ Sheet .. .. per ton	£15 2 6	£15	2/6 inc.
l Mica (uncut slabs 8" long) .. per lb.	6/6	6/6	..
m Manganin Wire No. 28.. .. per lb.	8/-	8/-	..
g Mercury .. .. per bottle	£8 5	£8 5	..
p Phosphor Bronze, plain castings per lb.	1/- to 1/4	1/- to 1/4	..
p „ rolled bars & rods per lb.	1/- to 1/4	1/- to 1/4	..
p „ r'l'd strip & sheet per lb.	From 1/2	From 1/2	..
o Platinum .. .. per oz.	£3 11 6	£3 11 6	..
p Silicium Bronze Wire .. .. per lb.	10d. to 1/1	10d. to 1/1	..
i Steel, Magnet, acc'd'g to desc'p'n p. ton	From £15	to £40	..
i Steel, Magnet, in bars	£58	£58	..
g Tin, block .. .. per ton	£111	£115	£4 dec.
g „ foil .. .. per lb.	1/6	1/6	..
n „ wire Nos. 1 to 16 .. .. per lb.	1/6	1/6	..
p White Anti-friction Metals— "White Ant" brand .. per ton	£40 to £65	£40 to £65	..
j Yarns, Cotton, Single 10lb. bundles pr lb.	7½d.	7½d.	..
j „ Flax, 6 or 8 lea... .. per lb.	4d.	4d.	..
j „ Hemp, 3 ply 10 lbs. .. per lb.	3½d.	3½d.	..
j „ „ Russian, 10 lbs. per lb.	4½d.	4½d.	..
j „ Jute, 180 lbs. rove .. per ton	£12	£12	..
j „ Manila, 24 thread .. per ton	£33 10	£33 10	..
k Zinc, Sheet (Vielle Montagne bnd.) p.t.	£31	£31	..

Quotations supplied by
a Messrs. G. Boor & Co.
b The British Aluminium Company, Ltd.
c Messrs. Thos. Bolton & Sons.
d
e

Quotations supplied by
f The India-Rubber, Gutta-Percha, and Telegraph Works Company, Ltd.
g Messrs. James & Shakspeare.
h Messrs. Jackson & Till.
i Messrs. Bolling & Lowe.
j Messrs. Henry C. Yeo & Co.

Quotations supplied by
k Messrs. Morris Ashby, Limited.
l Messrs. Sanders, Wake & Co.
m Messrs. W. T. Glover & Co., Ltd.
n Messrs. P. Ormiston & Sons.
o Messrs. Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Company, Ltd.

INSTITUTION OF ELECTRICAL ENGINEERS.

WE reproduce the following insulation tables from Mr. J. Pigg's paper on "Rules for the regulation of the wiring of premises for connection to public supply mains," read before the Institution some weeks ago. No explanatory letterpress is necessary :—

INSULATION TABLES.

Authority.	Insulation resistance complete installation. To earth.	Insulation resistance complete installation. Between mains.	Pressure. Testing.	Pressure. Working.	Motors. Insulation required.	Motors. Mounting.	Arc lamps. Insulation per lamp required.	Minimum insulation after supply has been commenced.	Range of specification	Insulation resistance per 64-watt lamp.	Insulation resistances of conductors megohm-miles.
BOARD OF TRADE.	10,000 E / A	10,000 E / A	...	...	...	...	...	...	No limit	100 v. 1·56 meg. 200 v. 6·25 meg.	.....
INSTITUTION OF ELECTRICAL ENGINEERS.	10 megohms / A	Not specified	Double that of working	...	Not specified. Follows from ins. res. test	Earthed for 250 volts and upwards	Not specified. Follows from ins. res. test	Not directly specified	No limit	100 v. 15·6 meg. 200 v. 31·25 meg.	Class A, 1,200 to 300 megohms. Class B, 300 megohms (at 60° Fahr. after 24 hours' immersion)
PHŒNIX FIRE INSURANCE CO. For continuous currents.	Lights. / Ohms. 12 / 1,000,000 25 / 500,000 50 / 250,000 100 / 125,000 500 / 25,000 1,000 / 12,500	The same as specified to earth	Not less than 100 volts	Maximum of 230 volts	Not specified	To be insulated	Not specified	Not specified	1,000 lamps	12·5 megohms per lamp for voltages up to 230	400 megohms for dry places; 1,000 megohms for damp places (at 60° Fahr. after 24 hours' immersion)
For alternating currents.	Double the above.									25 megohms per lamp for voltages up to 230	
LIVERPOOL AND LONDON & GLOBE INSURANCE CO.	40,000 E / A	40,000 E / A	Double that of working	Maximum of 250 volts	Not specified. Follows from ins. res. test	To be insulated	Not specified. Follows from ins. res. test	40,000 E / A	No limit	100 v. 6·25 meg. 200 v. 25·0 meg.	300 megohms (at 90° Fahr.)
ABERDEEN.	33-watt lamps. / Megohms. 12 / 5·00 25 / 2·50 50 / 1·50 75 / 1·25 100 / 1·00 150 / ·75 200 / ·50 250 / ·30 300 / ·20	Not less than one-third of insulations to earth	220 volts	110 volts and 220 volts	To be equal to the ins res. required for the number of 33-watt lamps taking same energy	To be insulated	Not specified	5,000 ohms	300 33-watt lamps or equivalent	Varies between 60 and 112 meg. per 33 watt lamp according to number of lamps installed	In dry places, 300 megohms; in damp places, 600 megohms; in plaster and walls, 1,000 megohms
BLACKPOOL.	20 megohms / N	Not specified	Not specified	200 volts	20 megohms / 10	Not specified	20 megohms / 10	20 megohms / N	No limit	20 megohms per lamp	Rubber-covered cables, 2,500 meg. after 24 hours' immersion. Testing press 400 v. Other cables tested with alt. press of 800 v.
BRADFORD.	10,000,000 / A	Not specified	Not specified	230 volts	Specified as 1 meg. Follows also from ins. res. test.	Not specified	Not specified. Follows from ins. res. test	10,000,000 / A	No limit	230 v. 35·6 meg	In dry places, 300 megohms; damp places, 600 meg.; plaster work, &c., 1,000 megohms
BRIGHTON.	20 megohms. / N	Method of making test not definite	Not specified	115 volts and 230 volts	20 megohms / 10	Not specified	20 megohms / 10	20 megohms / N	No limit	20 megohms	Not specified. Reference to Fire Office Rules

INSULATION TABLES (*continued*).

Authority.	Insulation resistance complete installation.		Pressure.		Motors.		Arc lamps.	Minimum insulation after supply has been commenced.	Range of specification	Insulation resistance per 64-watt lamp.	Insulation resistances of conductors megohm-miles.
	To earth.	Between mains.	Testing.	Working.	Insulation required.	Mounting.	Insulation per lamp required.				
Bristol.	Lamps. / Ohms. 10 / 1,500,000 20 / 1,000,000 30 / 700,000 50 / 500,000 100 / 250,000 150 / 200,000 200 / 150,000 250 / 100,000 300 / 75,000	Method of making test not definite	100 volts	105 volts and 210 volts	Not specified.	Not specified	Not specified	10,000 ohms.	300 lamps	Varies between 15 and 30 megohms per lamp, according to number of lamps installed.	Not specified. Work and materials to be to Phœnix Fire Office Rules.
Edinburgh.	Lamps. / Meg. 12 / 5 25 / 2·5 50 / 1·5 75 / 1·25 100 / 1·0 150 / ·75 200 / ·5 250 / ·3 300 / ·2	In no case less than 75,000 ohms	230 volts	115 volts alt. 230 volts continuous	To be equal to the ins. res. required for the number of lamps taking same energy	To be insulated ordinarily. 460 v. motor frames and shafts earthed	Not specified	10,000 ohms.	300 lamps	Varies between 60 and 112 meg. per lamp, according to number of lamps installed	In dry places, 300 megohms; in damp places, 600 meg.; in plaster work and walls, 1,000 meg.
Glasgow.	$\frac{60 \text{ megohms}}{N}$	Not specified	200 volts	200 volts	1 megohm	To be insulated	5 megohms	$\frac{A}{10,000}$	No limit	60 megohms	Consumer's underground service mains, 2,500 meg. Reference to Phœnix Fire Office Rules.
Hampstead Vestry.	$\frac{75 \text{ megohms}}{N}$	Method of making test not definite	105 volts	105 volts	Special arrangements with engineer			500 ohms.	No limit	75 megohms	Not less than 600 megohms
Huddersfield.	No rules issued.	Phœnix Fire Office Rules in force.									
Hull.	$\frac{40,000,000}{A}$	In no case less than 75,000 ohms	200 volts	110 volts and 220 volts	Not specified. Follows from ins. res. test	To be insulated	Not specified. Follows from ins. res. test	$\frac{A}{10,000}$	No limit	110 v. 69 meg. 220 v. 138 meg.	Never less than 600 megohms
Vestry of St. Mary, Islington, Extension Area.	100 lamp-meg. for installations of more than 10 lamps. Minimum for 10 lamps or fewer, 5 meg.	The same as specified to earth	Not specified	230 volts	Special rules are issued	Special rules are issued		100 lamp-meg. for installations of more than 10 lamps. Minimum for 10 lamps or fewer, 5 meg.	No limit	100 megohms for installations of more than 10 lamps. From 50 to 5 megohms for 10 lamps or fewer	Not less than 600 megohms
Yorkshire House to House Co., Leeds.	Lamps. / Meg. 25 / 2 50 / 1·25 100 / ·75 150 / ·5	Method of making test not definite	Not specified	100 volts and 200 volts	To engineer's approval			Not specified	150 lamps	Varies between 50 and 75 meg. per lamp	Rubber cables. In dry places, 600 megohms; in damp places, 1,000 megohms. Lead-covered cables to engineer's approval

(*To be continued.*)

SOME NEW FEATURES IN MOTO-VEHICLE DESIGN.*

By THOMAS H. PARKER, M.Inst.E.E.

Some two and half years ago I was spending my time supervising the erection of electrical and general plant in the Transvaal goldfields, and the necessity for an efficient motor controller often presented itself to me. After giving some considerable time and thought to the problem, I obtained a satisfactory result, and communicated the idea, by means of drawings, to my father, Mr. Thomas Parker, at Wolverhampton, for use in the factory. Soon after this, I heard the pleasing news that a Bill was to be presented to Parliament to allow of mechanical road locomotion in England, and was not long in grasping the fact that the controller would also adapt itself to controlling electrical road vehicles. Fired with this idea, and wishing to be in the first swim of a new industry, I started for England, and immediately after my arrival in Wolverhampton set to work designing an electric car. I selected a section of road over which it was obvious the car would have to run, viz, between Tettenhall and the town of Wolverhampton, a distance of 2½ miles without a single yard of level ground in its length, the gradients varying from 1 in 120 to 1 in 15. The first difficulty that presented itself was to obtain data to work upon. My idea was that 12 cwt. would be more than a reasonable weight to allow for an unloaded electric car for six passengers, and the nearest article I could find of this weight was a brougham. I procured a large spring balance, and set out at daybreak to map out a curve of the force required to draw the brougham over the track. We took the shafts off and attached the horse with the spring balance inserted between the animal and the vehicle, and not until that December morning had I fully realised the power of a horse, although I have had to deal with them all my life. My dream of 12 cwt. was at an end, for, after carefully working out all points, the weight totalled up to a minimum of 25 cwt. for a three hours' run at eight miles per hour. Having determined the approximate power required, the next most important problem was the design of the motor and gearing. After a great deal of discussion it was decided that it would be preferable to use two motors coupled by means of single or double reduction gear, running in oil, to the hind wheels, in preference to using a single motor and differential gear. Double spur gearing did not work in well with the design, the result of which decision was that chains had to be used on the second reduction, necessitating the use of eccentrics for taking up the slack or stretch of the chains, and two frames to support the motors separately. These first motors were series wound, and designed to run at 950 revolutions per minute, and give a torque effort of 30 lbs. on the periphery of each armature with a current of 25 amperes. Forty was chosen as the number of cells, to permit of their being charged in series on the usual 110-volt circuit. The controlling of the car came next. To do this without the use of resistance coils was a difficult matter at first, but eventually turned out to be one of the simplest. Three speeds forward and one backward were found to meet all requirements, and these variations were obtained by dividing the cells into two groups of 20 each. The three forward movements were obtained as follows:—First, by putting batteries in parallel, motor series, giving two miles per hour; second, batteries series, motor series, four miles per hour; and third, batteries series, motors parallel, eight miles per hour. The one backward movement, batteries parallel, motor series, with current in the armatures reversed, two miles per hour. The whole of the operations were carried out by means of the controller mentioned at the beginning of this paper with less than one single turn of the handle.

The steering gear presented itself next. I had heard a great deal of what had been done, and had seen a car with Ackermann gear, but was dissatisfied with it, and also the double cycle head arrangement. I wanted a steering gear that would admit of a car running round a small circle with as little resistance as going straight ahead, and, after a great deal of scheming, devised the idea of moving both front and hind wheels in opposite directions at the same time and through the same angle, which, both in model and practical form, worked splendidly. It enabled the car to be turned in its own length without turning the wheels under the body, and is naturally double as sensitive as a single bogie or broken axle gear. Another great advantage is, that it admits of all four wheels being driven, and the load being equally divided on all four wheels. It gives a good support to the bottom of the vehicle, which in most cases is made quite flat. Each wheel can be provided with a brake. A careful examination was made of the various types of batteries, and it was decided to give the Blot Company the order for the first set.

Having overcome the various points of difficulty on paper, some premises were rented in which it was just possible to build and put the car together, and as the weight of the car grew, we had to shore the floor up from beneath. Six weeks from the day we commenced the car was ready to be launched. I say launched, because it had to be lowered 18 inches into the square down some planks. Somehow the news leaked out that a trial was to take place, and we found a large crowd of people waiting outside when the doors were taken down, as there was not sufficient room to open them when the car was inside. You may judge from this how much chance we had to make a private trial. However, she was launched and ran a 10-mile trip, with nine people aboard, without a hitch. During the journey we had occasion to descend some very stiff gradients, and I found, although I had some powerful brakes upon the car, that it was with great difficulty I could restrain it from getting the better of me. Although I did not say anything to the passengers, I decided before the journey was finished not to attempt another trip with series motors. I had the motors dismounted and had them shunt wound, and, needless to say, had to stand a good deal of chaff for such a thing, as running shunt motors in conjunction with storage batteries on tramways had years ago been given up as impracticable. The motors were re-hung on the third day, the connections were made, and the car run down into the street, the result being beyond expectation. Instead of the sudden rush of current as at starting with the series motors, viz, 50 amperes, the car moved steadily away with less than 10 amperes, although the current was about the same when the rate of travelling accelerated. We then proceeded to take some tests on an incline. To do this we ran the double journey to Tettenhall and back. The work of manipulating the car was very much reduced, it only being necessary to set it to the required speed and look out for obstacles. On descending the stiffest hill the speed did not increase 5 per cent., and it was very gratifying to see the amperemeter reading 20 amperes to the good, charging the batteries instead of wearing the brake-blocks away. In case of need, it was found possible to bring the car to a stand from full speed ahead in 3 feet on a 10 per cent. gradient, without the use of the brake or reversing the motors, which was an impossibility with the series motors. This original car has been running almost daily for the past 18 months exactly as it was made, without a single breakdown, and has carried some of the most eminent men of the country upon it.

Fig. 1 is the original controller adapted for use with shunt motors

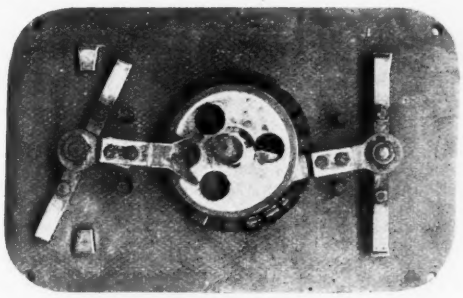


Fig. 1.

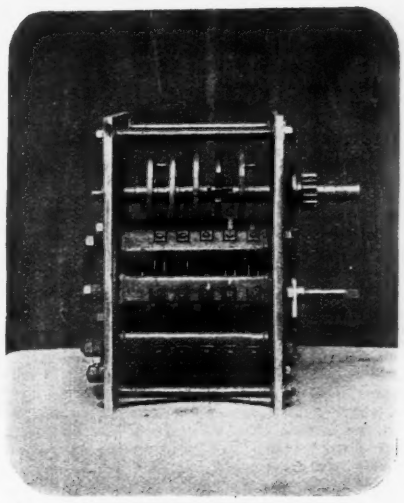


Fig 2.

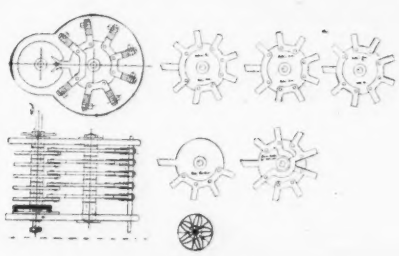


Fig. 3.

* Abstract of a paper read before the Liverpool Self-Propelled Traffic Association.

(To be continued.)

working on ordinary high tension circuits, to enable three movements to be made consecutively with one handle, locking and interlocking each movement. There are two rollers or discs fixed to the centre spindle, actuating two levers connected to the two switches, top and bottom. In starting from zero, the one disc, which is slightly in advance of the other, first puts on the shunt switch and locks it on, leaving the handle free to turn a

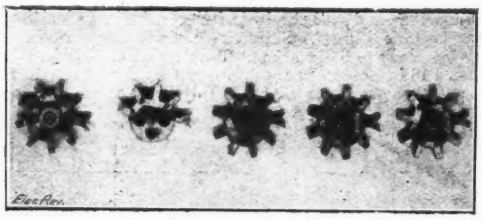


Fig. 4.

full revolution in the same direction. The next portion of the revolution puts on the main switch and locks it on, allowing the main current to flow through the armature with resistance in the circuit. This resistance is determined by the switch arm carried on the centre spindle below the discs working on an ordinary divided resistance ring, and, in this case, admits of 24 points of regulation in a single turn of the handle. When stopping the motor, it follows that the maximum resistance must be put into the circuit ready for starting. Again, the main current must be broken before it is possible to break the shunt, thereby avoiding all danger of burning out the armature, which would be the case if the shunt were broken first. Further, if the motor has to be stopped and started often, as in the case of hauling of omnibus work, the shunts can be left on, as shown, by which arrangement no damage is done to the insulation by the high voltage due to induction on breaking shunt circuits.

Fig. 2 shows the controller as adapted to the electric cars. The spindle in this case carries five discs connected to levers projecting from discs, as shown by fig. 3. From each of these discs project eight teeth, which connect with eight bars, which are connected to the batteries and motors. The various combinations are obtained by connecting the eight teeth together in various ways shown in fig. 4. The whole of the five movements are obtained in about three-quarters of a revolution of the handle, and each movement is locked and interlocked in its proper order.

(To be continued.)

STEAM MAINS FOR ELECTRIC SUPPLY STATIONS.

An excellent article on steam pipes appears in *Engineering* by Mr. R. Summerfield. He starts out on the correct assumption that a properly designed steam pipe is no more liable to fail than a boiler, and, therefore, that duplicate and ring mains are a useless and costly anachronism. He might have added dangerous. Further, he points out they are wasteful. The troubles to be guarded against in a steam pipe are water hammer and leaky joints. The latter are caused by the contraction of pipes when cold, and are best provided against by loop or U bends in the pipes at suitable distances. Expansion may vary a pipe 1 inch in each 50 feet, and expansion sockets are not suitable to overcome this, as they will leak if not packed too tightly to fulfil their intended duties. We have ourselves found expansion discs to be troublesome, and they are bad in principle unless the two ends of a pipe are securely anchored. Pipes should be laid free to move longitudinally on rollers. A novelty in the shape of joints is proposed. It is suggested that pipes should be riveted together at the flanges, like Adamson's flanged seams.

The valves only should be bolted. This would stop leaks at flanges. Joints are also shown to be made by means of loose flanges slipped over the pipes, which are then welded to a stiff, thick, small collar flange. This allows play at the joints, the ring of joint material being slipped between the narrow-faced flanges, and these being pulled together by bolts through the loose flanges. The expansion bends named above must not be placed vertically, but horizontally, to avoid water action. They may be 50 to 100 feet apart, according to the number of branches. Where supported on rollers, a piece of iron should take the rolling wear, moving with the pipe. Sling rods should be at least 2 feet long, with adjustable screw ends for levelling the pipe when hot. No pipes should rest on a brick wall or be built in. There should be perfect freedom from contact. No combustible material should be used as a covering. Flange covering is a questionable matter we are told. Should it rather be said that flanges should have their bolts exposed, but should be fitted with a removable box cover, hinged and clasped in halves. As regards valves, it is recommended to put one on every branch close to the main in addition to the engine and boiler stop valves, but valves between one engine and the next on the steam main are not necessary, though in a long main one or two valves may be used to shut off a part if required. All valves should have bye-passes. Steel lap-welded is the material to be used for pipes, copper being now rare, and if used to be riveted if large, not brazed, which is so uncertain and dangerous.

Small pipes of copper can, of course, be seamless. Valve bodies must be of steel for modern high pressures, the valve and spindle being gun-metal or phosphor bronze, and the closing of a valve should be fairly rapid. Tee pipes also must be of steel owing to the trouble often experienced with welded tees.

THE WORK OF THE BRITISH ELECTRIC TRACTION COMPANY.

The following details are given as an appendix to the report of the above company which appeared in our "City Notes" last week:—

Barnsley.—The B.E.T. Co. has applied for an order under the Light Railways Act.

Barrow-in Furness Tramways, Limited.—An agreement has been made for the purchase of this undertaking by the B.E.T. Co.

Bexhill and St. Leonards.—The B.E.T. Co. is promoting a Tramroad Bill in the present session of Parliament.

Bournemouth and Poole.—An order under the Light Railways Act for the construction of light railways has been granted by the Commissioners, subject to the approval of the Board of Trade. The B.E.T. Co. has, with the approval of the Commissioners, ceded an interest in this order to others.

Brighton and Shoreham Tramway Company, Limited.—Subscribed capital £9,170. The B.E.T. Co. has acquired the majority of the shares in this company. The company own tramways (4½ miles) authorised by provisional order, 1882, and is working the same by horses at a profit.

Cambridge Street Tramways Company.—The B.E.T. Co. has made a conditional agreement for the purchase of this undertaking.

Coatbridge and Airdrie.—An order under the Light Railways Act has been granted to the B.E.T. Co. by the Commissioners for the construction of light railways but the Board of Trade have not confirmed the same. A Bill has been presented in Parliament to confirm the order.

Colchester.—The B.E.T. Co. has applied for an order under the Light Railways Act.

Cork Electric Tramways and Lighting Company, Limited.—The company owns tramways (7½ miles) authorised by Order in Council, 1897, and has since January last been working the same by electricity. The company also owns the electric lighting order for Cork. The B.E.T. Co. has a substantial participation in this undertaking.

Crewe.—A light railway order has been granted by the Commissioners, but owing to the onerous conditions imposed by the Corporation of Crewe, the B.E.T. Co. has asked the Board of Trade not to confirm the order.

Devonport.—An agreement has been made under which the B.E.T. Co. has acquired a controlling interest in the Devonport and District Tramways Company, which has powers to construct electric tramways in Devonport, under the Devonport and District Tramways Act, 1898.

Dudley and Wolverhampton Tramways, Limited.—An agreement has been made for the purchase of this undertaking by the B.E.T. Co. A provisional order has been deposited with the Board of Trade to authorise (*inter alia*) the alteration of gauge and the working by electricity.

Dudley, Stourbridge and District Electric Traction Company, Limited.—Subscribed capital £61,890. The B.E.T. Co. holds the majority of shares of this company. The company owns the tramways authorised by provisional orders of 1881, 1885 and 1886 (5 miles), and is working the same at present by steam at a profit.

Agreements have been made with all the local authorities for an extension of tenure. The lines are in course of conversion to electric traction.

The company has obtained a Light Railway Order for the construction of extensions (8¾ miles), and is applying for an order under the Light Railways Act for further extensions of these lines.

Gateshead and District Tramways Company.—The B.E.T. Co. has made a conditional agreement for the purchase of this undertaking, and a Bill is being promoted in Parliament for an extension of tenure and for the adoption of electric traction.

Greenock and Port Glasgow Tramways Company.—The B.E.T. Co. has made a conditional agreement for the purchase of this undertaking, and a Bill is being promoted in Parliament for an extension of tenure, and for the adoption of electric traction.

Hartlepools.—The General Electric Tramways Company, Limited. Subscribed share and debenture capital £33,500. The B.E.T. Co. has acquired all the shares and debentures in this company. The company owns the tramways authorised by provisional order of 1883 (2½ miles) and works the same by electricity at a profit.

Agreements have been made with the local authorities for an extension of tenure.

The B.E.T. Co. has acquired the provisional order, 1895, for extension of the tramways (2 miles) and these lines have been constructed and electrically equipped and have recently been opened for traffic.

An order has been obtained under the Light Railways Act for further extensions (2½ miles).

Immisch Electric Launch Company, Limited.—Subscribed capital £10,465. The B.E.T. Co. has acquired a large proportion of the shares in this company. The company owns a fleet of about 20 electric launches on the Thames, and is earning a profit.

Kidderminster and Stourport.—An Act of Parliament (1896) has been obtained authorising electric tramways (4½ miles). The tramways were opened for traffic in May last and are working at a profit.

An agreement has been made by the B.E.T. Co. with the Kidder-

minster Corporation for the transfer of the Electric Lighting Order obtained by the Corporation.

Kinver.—An order (1899) under the Light Railways Act has been granted to the B.E.T. Co. for the construction of light railways (4 miles).

The lines are now in course of construction.

Leamington and Warwick Tramways Company, Limited.—A conditional agreement has been made by the B.E.T. Co. for the purchase of this undertaking.

Merthyr.—An order applied for by the B.E.T. Co., under the Light Railways Act, has been granted by the Commissioners subject to confirmation by the Board of Trade.

An order under the Electric Lighting Acts has been applied for with the approval of the local authority.

Middleton.—An order (1898) under the Light Railways Act for the construction of electric railways (8¼ miles) has been granted to the B.E.T. Co.

North London.—The B.E.T. Co. has a participation in the Light Railway Orders applied for by the Metropolitan Tramways and Omnibus Company, Limited.

North Shields and Tynemouth District Tramways, Limited.—Subscribed capital £6,000. The B.E.T. Co. has acquired the majority of the shares of this company. The company owns tramways (2½ miles) authorised by provisional orders 1879, 1882 and 1885, and is working the same by steam at a profit.

An agreement has been made with the Corporation of Tynemouth for the adoption of electric traction and for the supply by the Corporation of electrical energy.

An order (1899) under the Light Railways Act for extension of the lines (2½ miles) has been approved by the Board of Trade.

Oldham, Ashton and Hyde Electric Tramway, Limited.—Subscribed capital £80,000. The B.E.T. Co. holds a large proportion of the ordinary shares in this company.

The company owns electric tramways authorised by provisional order 1896 (8 miles).

The tramways are constructed and electrically equipped ready for working, but the company is waiting for the Corporation of Ashton to supply the electrical energy under a contract which has been made with that Corporation.

Pontypaidd.—The B.E.T. Co. has recently completed the purchase of these tramways (3 miles) at present worked by horses.

Potteries Electric Traction Company, Limited.—Subscribed capital £400,000.

The B.E.T. Co. holds a large proportion of the ordinary shares in this company.

The company owns electric tramways authorised by provisional order, 1896 (13 miles). These tramways are in course of construction and equipment.

The company also owns a light railway order, 1897, for extensions (14 miles). These lines are also in course of construction and equipment.

The company has further acquired the majority of shares and debentures of the North Staffordshire Tramway Company. Subscribed share and debenture capital £155 900.

The latter company owns tramways authorised by several provisional orders under the Tramways Act (7 miles).

These tramways are worked at present by steam at a profit, but the tramways have already been reconstructed and equipped for electric traction and will be worked electrically very shortly.

Rossendale Valley Tramways Company.—Subscribed share and debenture capital £65,640. The B.E.T. Co. has acquired a substantial interest in the company.

The company owns tramways (6¼ miles) at present worked by steam at a profit.

A Bill has been introduced in Parliament to authorise electric traction.

The Birkdale and Southport Tramways Company, Limited.—The B.E.T. Co. has made an optional agreement for the purchase of this undertaking. A provisional order has been applied for to authorise extensions of the tramways, and physical junctions with the existing tramways in Southport and Birkdale.

South Staffordshire Tramways Company.—The B.E.T. Co. holds the majority of the debentures of this company.

The B.E.T. Co. works the electrical tramways of the company (8 miles), which are a source of profit.

There is also an agreement between the company and the B.E.T. Co., which provides (*inter alia*) for an option to the B.E.T. Co. to work the whole of the tramways of the company.

A Bill has been introduced in Parliament to authorise electric traction and to grant an extension of tenure in respect of all the tramways of the company.

Spen Valley.—The B.E.T. Co. has applied for an order under the Light Railways Act.

Swansea Improvements and Tramways Company.—Subscribed share and debenture capital £194,780.

The B.E.T. Co. has acquired the majority of the shares.

The company owns tramways authorised under Acts of 1874, 1878, 1879, and 1882, and is working the same by horses at a profit.

Statutory powers for electric traction have been obtained, and the tramways are now in course of conversion for working by electricity.

The company also owns some lands and buildings in Swansea.

An order under the Light Railways Act for extensions of the lines has been applied for.

The company is negotiating a lease of the Swansea and Mumbles Railway and Pier.

Wolverhampton Tramways Company, Limited.—The B.E.T. Co. has made a conditional agreement for the purchase of the company's lines outside the Borough of Wolverhampton.

A Bill has been introduced in Parliament to authorise the alteration of gauge and the adoption of electric traction.

An order has been applied for under the Light Railways Act for extensions of the lines and for connections with the tramways of the South Staffordshire Company and the Dudley and Wolverhampton Tramways Company.

Windermere.—An agreement has been made with the Windermere Electricity Supply Company, in view of the promotion of a light railway.

Wigan Tramways Company.—A conditional agreement for the purchase by the B.E.T. Co. of this undertaking has been made.

Worcester Tramways, Limited.—A provisional agreement for the purchase of this undertaking by the B.E.T. Co. is being entered into.

There are other investments and provisional arrangements which have been made, and negotiations are pending in regard to a number of other undertakings, but, says the report, it would be premature and inexpedient to refer to them at this stage.

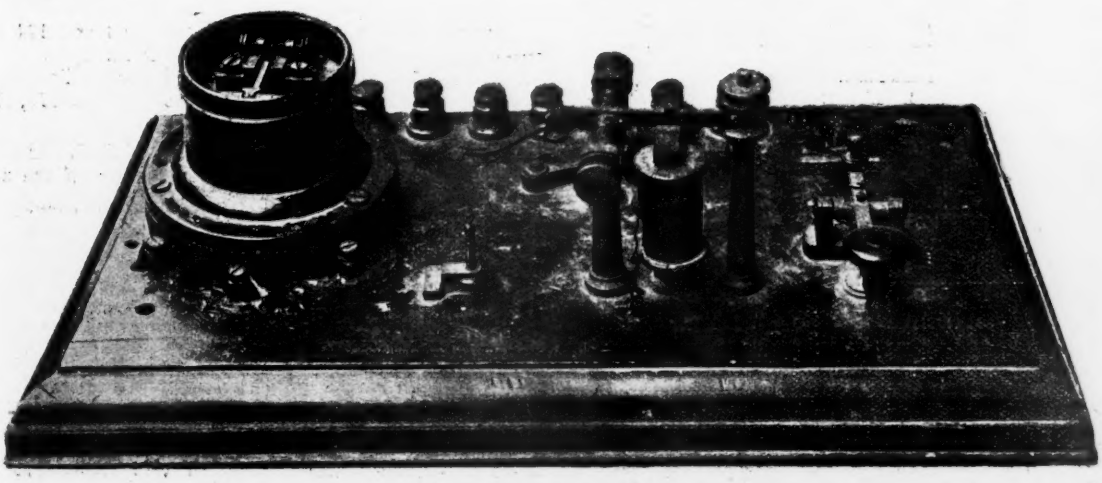
Southport and Birkdale.—*Southport Tramways Company, Limited.*—Subscribed capital £19,500.

The B.E.T. Co. has acquired the majority of the shares.

The company holds a lease from the Corporation of Tramways in Southport, and owns some lines in Birkdale, altogether 5¾ miles.

A TELEGRAPHIC RELIC FROM OMDURMAN.

Messrs. Siemens Bros., Limited, have been good enough to send us the following information regarding an interesting relic from the Soudan:—



The Relic from Omdurman.

After the battle of Omdurman, one of the sergeants of the Royal Engineers, working under the Director of Army Telegraphs, Egyptian Army, on entering the south end of Omdurman at the Khar Shambat noticed a telegraph wire,

and following it up found the instrument shown in the illustration connected up to the line in a hut, and in charge of an old Egyptian telegraph clerk, who had been forced to work the line as a prisoner.

The station was the terminal of a circuit, Khar Shambat to the Arsenal at Omdurman by aerial line, and from the latter to the dockyard at Khartoum by cable, this line had been worked by the Khalifa since the capture of Khartoum and the building of Omdurman.

The apparatus shown in the illustration were sent home in the condition in which they were found, and are now the property of the officers of the Telegraph Battalion stationed at Aldershot.

In consequence of the relay mounted on this board bearing the name of Messrs. Siemens Brothers & Co., Limited, the attention of this firm was drawn to the trophy, and some very interesting facts were elicited.

It was found that the Siemens' relay was one of a consignment of 12 sent out by the firm to General Gordon's personal order in 1878, and the General's autograph letter of instruction dated from Khartoum is still in the possession of the firm. A copy of it is given at the foot.

A number of other instruments have been brought home, but most of them have been taken from the Arsenal at Omdurman and were not in use.

By the kind permission of the officers of the Telegraph Battalion it is probable that this very interesting Soudan relic will be included in Messrs. Siemens Bros. & Co.'s exhibit at the Article Club Exhibition to be held at the Crystal Palace during the summer of this year.

W. Siemens, Esqre., 22, Queen Ann Gate, Westminster, W.

Kartoum, 13 *July*, 1878.

Dear Sir,

Would you kindly have packed carefully and sent to Suakin, *viâ* Jeddah, by British India Steam Company, insured agst ordinary risk, and addressed to me, the enclosed list of Stores.

Will you send the Bill to me direct. I have asked my sister,

Miss Gordon,
5, Rockstone Place,
Southampton,

to pay you two hundred Pounds, which must do till I know the amount of your Bill.

Please give me the benefit of any discount you can afford. I hope you will include in all Bills, all expenses of freight, dock dues, &c., &c., to Suakin, or at any rate to Jeddah, so that one payment will cover everything.

I shall want many more things ere long, *i.e.*, when the finances of the Soudan will allow of my paying for them.

Please send me any price lists of telegraph stores you may have.

Mr. Geigler, one of your pupils, is Director of the Soudan Teleghs,

Yours sincerely,
C. G. Gordon.

SIPHON RECORDER SIGNALS.

By J. RYMER-JONES.

(*Concluded from page* 194.)

Long cable C.—Condensers of 50 mfds. at both ends. 30 cells.

16 w p.m. Recr. s = 620$^{\omega}$.

Slip 167 No leak on cable. s on R C = 7,000$^{\omega}$.

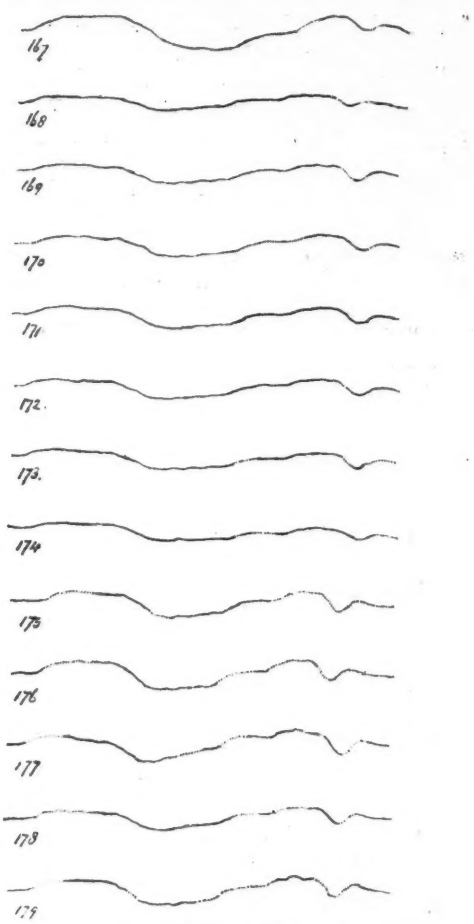
177 no leak and no s on condensers.

178 with 7 leaks of 10,000$^{\omega}$ at *a*, *b*, *c*, *d*, *e*, *f*, *g*.

179 „ „ 20,000 „

Note.—s = 7,000$^{\omega}$ on R C to bring the natural signals without any leak parallel with the zero line.

Slip 177 is for no leak on the cable and no shunt on R C. This slip therefore shows the normal *fall* which is counteracted in slip 167 with 7,000$^{\omega}$ on R C.



Slips 167 to 179.

As there are condensers at both ends, 168 and 174 are practically the same, being most affected in size by the leaks. Signals in 170 and 171 are larger and show a little more definition, but there is not much to choose between 170, 171, 172, or 173.

Slip 175 for 5 leaks of 10,000$^{\omega}$ is slightly better than these former, as signals stand a little further off the zero line, and 178 for 7 leaks of 10,000$^{\omega}$, is perhaps slightly the best of all, but differences are so very slight that the more or less free movement of the siphon may in some measure be accountable. All that can be said with certainty is that 171, 175 and 178 are better than 167 without any leak, and if a higher shunt on the recorder coil be used these three conditions would give a *slightly* higher speed than for the conditions of 167.

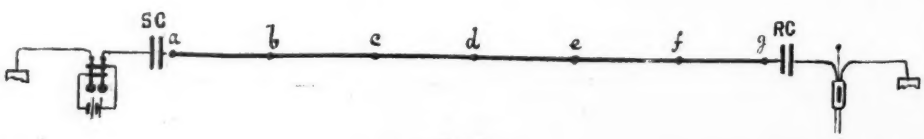


Fig. 3.

Slip 168 with 1,000$^{\omega}$ leak at point *a*.
169 „ „ *b*.
170 „ „ *c*.
171 „ „ *d*.
172 „ „ *e*.
173 „ „ *f*.
174 „ „ *g*.
175 with 5 leaks of 10,000$^{\omega}$ at *b*, *c*, *d*, *e*, *f*.
176 „ „ 20,000

Shorter cable *c*. No condensers at either end. 30 cells. 16 w.p.m.
Recr. s = 9$^{\omega}$.

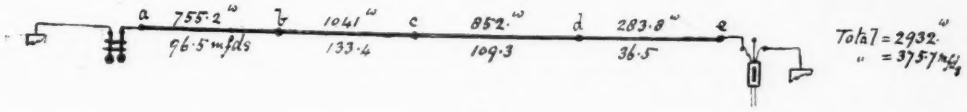
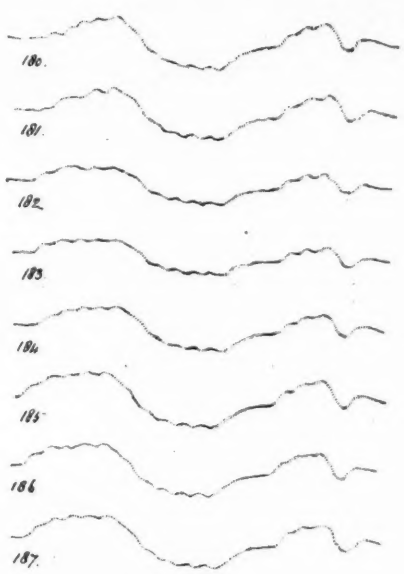


Fig. 4.

Slip 180 no leak on cable.
181 with 1,000$^{\omega}$ leak at point *a*.
182 „ „ „ *b*.
183 „ „ „ *c*.
184 „ „ „ *d*.
185 „ „ „ *e*.
186 with three leaks each 10,000$^{\omega}$ at *b*, *c*, *d*.
187 „ „ 20,000.

Slip 180 shows the normal signals rising considerably. With 1,000$^{\omega}$ at point *c* consecutive elements are most parallel



Slips 180 to 187.

with the zero line, and therefore definition is improved by the fact that leaks make signals *fall* owing to improved discharge between the several elements. With 1,000$^{\omega}$ at either end (181 and 185) signals are practically the same both for size and degree of *rising*.

With 10,000$^{\omega}$ at three points (186) signals are not so good as 183, where the discharge is facilitated at one point *c* instead of, to a less extent, at three points.

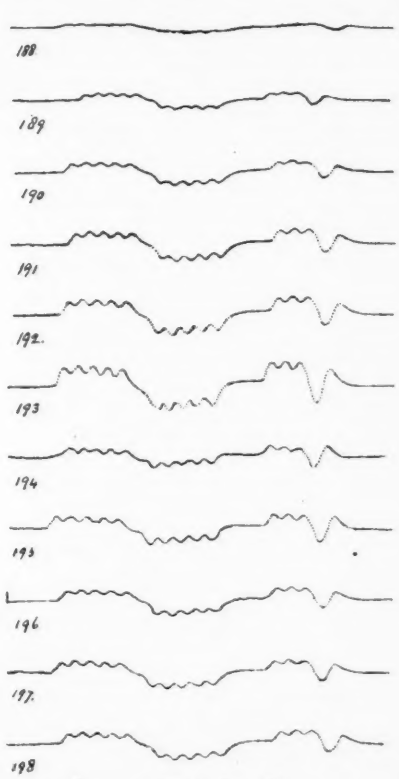
Although leaks with an increased battery power and high resistance shunt on the recorder may increase the speed of working slightly, it will be seen that leaks alone promise little advantage, since any improved definition is accompanied by a decrease in the size of signals and would disappear with a very insignific..nt increase in the speed. At any rate, the effect of leaks is very different from the remarkable improvement which Prof. Silvanus Thompson anticipates. Any substantial increase must be looked for rather from more sensitive receiving instruments and *curb transmitters* based on the laws of the propagation of electric waves through a long cable. Thus the automatic curb transmitter of Dr. Muirhead is said to increase the speed of working on some cables as much as 30 to 40 per cent., and the new method of photographing the movements of the *mirror instrument's* reflected light beam, invented by M. Ader, very greatly increases the speed of working through a very long cable.

Effect of Shunting the Recorder Coil = 500 Ohms.

Shorter cable *c*. s c = 50 mfds. R C = 20 mfds. 16 w.p.m.

Slip 188	s on Recr.	= 40	30 cells.	Slip 194	5 cells, s on Recr. = 2,000$^{\omega}$
189	„	= 80		195 10	„ „ = 200
190	„	= 120		196 15	„ „ = 350
191	„	= 160		197 20	„ „ = 250
192	„	= 200		198 30	„ „ = 150
193	„	= 300			

Specimen slips have been obtained when working through two different lengths of artificial cable; first, when varying the shunts, with a constant number of cells, and afterwards when varying both battery and shunt so as to give approximately the same size of signals.



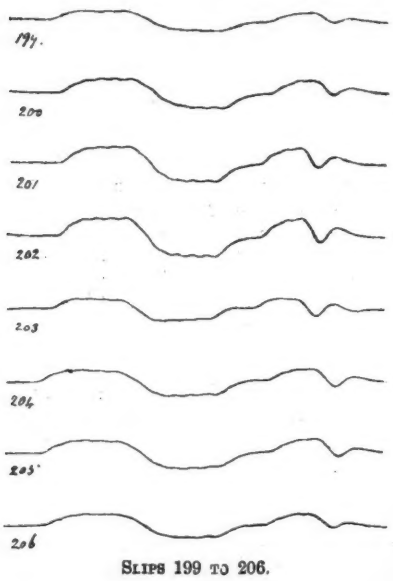
Slips 188 to 198.

Shunting the Recorder coil is useful for adjusting the size of signals when they are well defined and inconveniently large, but, if small, inserting a shunt, or reducing its resistance, tends to round off the crests of received signals so that they become less sharply defined. Varying the shunt resistance, moreover, alters the period of the coil by reason of its damping effect; consequently the resistance which is best suited to one speed of signalling will, under certain conditions, make signals at a higher speed illegible, because the period of the coil becomes unsuited to the increased speed.

In an interesting brochure describing his latest improved form of siphon recorder, Dr. Muirhead shows very graphically that in the case of very long cables better definition, and a considerable increase in speed, is obtained by judiciously tightening the suspension, thereby quickening the period of the coil.

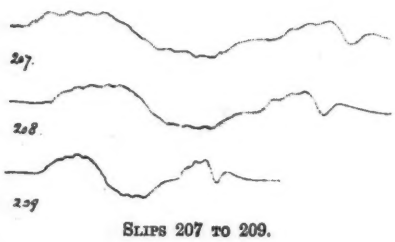
Longer cable c. s c = 50 and, n c = 50 mfds. 16 w.p.m.

Slip 199	s on Recr.	=	250	30 cells.	Slip 203	5 cells, s on Recr.	=	20,000 ω
200	"	=	500		204 10	" "	=	750
201	"	=	750		205 20	" "	=	250
202	"	=	1,000		206 30	" "	=	120



Slips 199 to 206.

It will be seen from the above slips that the smaller shunts have, in proportion to their resistances, a much greater effect in reducing the size of signals than is calculated from the ordinary shunt formula $\frac{G + S}{S}$; the reason being that when a shunted coil moves in a magnetic field, currents are set up



Slips 207 to 209.

in the coil which in effect are tantamount to a momentary increase in its resistance, so that the ordinary law of shunts does not apply.

Since the pointed or rounded tops of signals through a cable of given K R depend on the amplitude of the signals in a given interval of the time—the larger signals making a larger deflection in the same time as smaller deflections—it is obvious that reducing the shunt resistance, and thereby making signals smaller, causes them at the same time to have less pointed crests, and in this way modifies their shape. It follows also that if the rate at which the slip travels be increased the crests of signals will be rounded off still more, hence the speed of the slip should be suitably regulated to the speed of signalling.

Effect of the Speed of the "Slip" on Received Signals.

Slip 207.	Speed of slip	44	inches per minute.		Usual speed.
208.	"	36	"	"	Intermediate.
209.	"	25	"	"	Slow.

It will be seen from these slips that slowing down to 25 inches per minute increased the definition and makes signals more compact, hence the advantage of regulating the speed of travelling to get the best effect.

Effect of Varying the Distance between the Bifilar Suspensions of the Recorder Coil.

Length of fibres in each case = 2 inches.

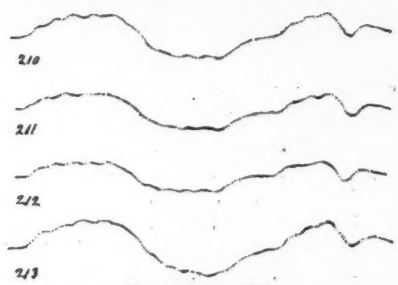
Slip 210 shows the shape and size of signals at starting.
Distance between fibres ... ... = $\frac{5}{32}$ inch.

Slip 211 shows the shape and size of signals after increasing distance between fibres.

212 shows the shape and size of signals after increasing still more to ... ... $\frac{9}{32}$ inch.

213 shows the shape and size of signals after decreasing the distance between fibres to ... $\frac{5}{64}$ "

These slips show that decreasing the distance, *i.e.*, making the coil more sensitive, tends to make signals more wavy; whereas putting the fibres further apart tends to prevent the



Slips 210 to 213.

signals from rising, and to give them greater definition. In other words, putting the fibres wider apart is equivalent, *in its effect* on rather wavy signals, to the curbing produced by using condensers.

Advantage was taken of the adjustable pole pieces of a Muirhead siphon recorder, available at a date previous to these experiments, to ascertain the effect on received signals produced by varying their distance from the side of the suspended coil by means of the milled-head adjusting screw.

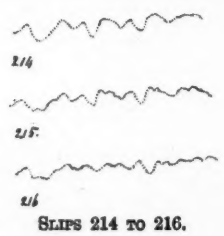
Effect on Signals of Varying the Intensity of the Magnetic Field.

Muirhead's Recorder.

Slip 214 obtained with pole pieces, 0·05 in. from the sides of the coil.
215 " " 0·11 in. " "
216 " " 0·20 in. " "

Note.—For comparison the same word "*wells*" is given in each case.

Not only are signals in the last case very much smaller, but they are also more shaky. The facility with which the pole pieces may be withdrawn to remove particles of dust from



Slips 214 to 216.

between the poles and the coils, enables them to be approached nearer to the coil for working than would be desirable with those recorders which require that the coil be removed, and consequently a higher degree of sensibility may be secured.

The writer is aware that the foregoing remarks on the recorder instrument deal with the several headings rather briefly, but the illustrations will speak for themselves and enable others to draw their own conclusions and compare practical results with mathematical dicta based it may be on not too well-founded theory. The fact that so little has hitherto been published on the subject justifies the expectation that they may assist many to a clearer comprehension of an important subject, and perhaps induce others to give the benefit of their experience and experiments.

In conclusion, I must acknowledge my indebtedness to my colleague, Mr. E. Raymond-Barker, of the Silvertown Works, without whose able assistance I should scarcely have succeeded in obtaining the numerous illustrative slips required for so many and varied experiments.

MR. HANBURY AND THE TELEGRAPH CLERKS: A REPLY.

By CHAS. H. GARLAND.

Mr. W. C. Steadman, and the members of the House of Commons who supported his amendment to the Address, raised issues which fall into two classes. First there were matters affecting the pay and prospects of telegraph clerks, and then there were matters affecting the rights of combination. In dealing with Mr. Hanbury's speech in reply, we will consider the issues in this order.

Before discussing the points of detail in connection with pay and prospects, it will be necessary to deal with a general principle concerning the relations of the Postal Department with its employés. "By increasing these salaries," said Mr. Hanbury, "we are bringing into this service an entirely new social class; you are bringing in men who are perhaps socially a little above their work, and these men naturally have a standard of living and requirements which are not essential to men doing work of this kind. If we are going to raise the salaries more and more, you will get a higher social class in the service, and there will be no limit to the demands made upon us" (*Hansard*). This theory of progressive discontent, of automatic increase of unrest, has been christened "Hanbury's law" by the London *Daily News*. But it is possible to trace it back to an earlier period in Postal history than that in which Mr. Hanbury figures as the Parliamentary apologist of the Post Office. Mr. Lewin Hill has given some publicity to this theory in his numerous "good-bye" interviews with reporters, and he attributes its discovery to his celebrated uncle, Sir Rowland Hill. But, without further concerning ourselves with the origin of this principle, it will be well to devote a few words to its consideration.

The progress of the Postal worker has been part of a great national progress in the condition of the working classes. If we turn to Sir Robert Giffen's "Essays in Finance" (second series), and read the two papers on "The Progress of the Working Classes in the Last Half Century," we shall find abundant evidence to prove that during the period 1837—1887, so far as the male worker is concerned, there has been a rise of wages in all trades of 50 to 100 per cent. In all skilled trades there has been a continual rise in the standard of life accompanying the rise in the national prosperity. The long-continued peace has permitted this standard of comfort to be passed on, and become the necessity of the classes performing the work. The tendency of the age is to further elevate this standard of life. The influence of free education, the dissemination of cheap literature, and the whole energy of municipal enterprise in the opening up of recreations for the people, are potent factors in the increase of the "wants" of the working classes. When those "wants" have become an integral part of the standard of life, the power of the worker will be directed to their satisfaction. This permanent elevation of the standard of life, this increase in the essential wants of the working classes, is the aim of all those who desire to raise the condition of the wage earner, and is the *sine qua non* of the progress of the people. The Post Office has shared in the general rise. The mean wages of telegraph clerks show an increase of 41·7 per cent. in the period 1872—97, which is covered by the "Return relating to the Pay of Telegraphists, &c.," issued June 9th, 1898. But from such a participation in national progress, the Postal authorities would extract an argument in favour of finality. Having for a short period, and in a halting manner, taken part in the march of the age, they would make it an excuse for crying "Halt." The standard of life of the workers has increased, and is continually increasing, yet the Post Office pleads that no longer should it be asked to keep abreast of the times. As the *Daily News* says, "Privation is, of course, strictly relative to the standard of comfort, and when this has gone up all round, there is logic in the demand for better pay. Perhaps Mr. Hanbury has proved too much."

Another point crops out from the same portion of Mr. Hanbury's speech. He makes the remarkable assertion that the men are "socially a little above their work." Yet, during the last few years, the standard of examination imposed by the Civil Service Commissioners has been raised by the inclusion of a new subject and the extension of the scope of subjects. Has the Postal Department made any protest against such a rise of standard? In order to be consistent with himself, Mr. Hanbury was bound to belittle the work of the operator. "Telegraphists," he says, "talk as if this operating work was a superior kind of skilled work, but it is only, after all, a superior kind of typewriting." The two assertions—first, that the men are too good for their work, and, secondly, that the work is not highly skilled, may well be coupled for consideration. Such matters are, for the most part, matters of opinion. Mr. Hanbury's opinion is not the opinion of an expert, and is at best *ex parte*. It will, therefore, be of interest to take the opinion of other men well qualified to judge. We have in our possession a number of such opinions, of which the following are typical:—Prof. Andrew Jamieson, M.Inst.C.E., F.R.S.E., &c., writes: "From an intimate knowledge of telegraphists and their duties since 1873, I am of opinion that their work requires far more technical skill than typewriting; and further, I can personally vouch for the fact that the efficiency of telegraphists has greatly improved of late years." Dr. R. M. Walmsley, Principal of the Northampton Institute, writes: "In connection with Mr. Hanbury's statement, I would like to say that the whole idea of offering additional advantages to the operators who qualify by passing certain technical and science examinations, proves that at least, in some official quarters, the work is regarded as requiring knowledge of applied science." These are two typical opinions of many. They can be supplemented by the following from Sir John Leng, M.P., who is also a well-known newspaper proprietor and editor:—"I am of opinion that telegraphy for press purposes, in which I am more particularly interested, requires a good deal more than merely mechanical skill. Unless the telegraphist is a man of superior intelligence, a reading man well informed on the current topics of the day, and vigilantly careful in dealing with, sometimes, not over legible manuscripts, he is sure to make blunders, sometimes ridiculous, and sometimes of a serious character." These views are confirmed by many others. Mr. Hanbury may therefore, we think, be left to the enjoyment of his belated opinion upon the skill required in telegraphy, and the hyperculture of the telegraphist.

When Mr. Hanbury was dilating upon the alleged large benefits conferred upon Postal workers since 1872, Mr. Spicer, the member for Monmouth Boroughs, made a most apt interpolation. "May I ask," said that gentleman, "whether their efficiency has also increased?" To this the Secretary to the Treasury replied, "I am bound to say that I do not suppose it has in proportion to the increase in the salaries." This statement stands uncorrected in *Hansard*, so we can assume that it was deliberately made. If there has been no increase in the demands upon the men, one is tempted to asked upon what logical ground has the increase in the salaries been made? The only reply would be that the increase was made in response to the elevation of the general national standard of life. To such an answer Mr. Hanbury would oppose his theory of progressive discontent. But there is evidence to show that whatever may have been the real reasons for the increase of pay, the increased demand upon the workers has at least been among those given to the House of Commons. In 1881, during the period referred to by Mr. Hanbury (1872—97) Mr. Fawcett made an increase which forms the greatest forward move of the 25 years. And in explaining that increase to the House of Commons Mr. Fawcett made the following remarks:—

"Among the hundreds of communications which he received on the subject was a letter from the representative of a newspaper, who said that the work of telegraphists, owing to an improvement in the instrument, had become more difficult, and they required greater skill, and that they did their work with such remarkable accuracy that their wages should be increased. It was that consideration more than anything else which induced him (Mr. Fawcett) to recommend a considerable increase of wages."

This leaves untouched the question of fact. Has there been any large increase in efficiency since 1872. No better judge exists than Mr. W. H. Preece, F.R.S., the late engineer-in-chief of the Post Office, who wrote thus in 1893:—"The progress of telegraphy has been phenomenal. That progress has been marked by a steadily-increasing

demand for the exhibition of technical knowledge and skill on the part of the artisans and operators engaged in the engineering and commercial branches of telegraphy in this country, and we are able to bear witness to the fact that those concerned have responded to this demand in a way that does them infinite credit. A standard of technical knowledge that was exceptional in the telegraph service a few years ago, is now the rule, and the time is not distant when we shall look in vain and without regret for the engineering or commercial employé who has no knowledge of the principles of the science."

(*To be continued.*)

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1899.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, *to whom all inquiries should be addressed.*

4,845. "Improvements in apparatus for registering the supply of electricity." L. Zahn. Dated March 6th.

4,863. "An improved indestructible insulator for electric engineering purposes." W. Cook and W. Kinzett. Dated March 6th.

4,865. "An improved electro-gilding process and apparatus to be used in connection therewith." B. J. Round, B. J. Round, and A. Round. Dated March 6th.

4,878. "An improved case for electrical transformer connections, also applicable to street electric light standards." G. Wilkinson. Dated March 6th. (*Complete.*)

4,879. "A new or improved electric battery cell and elements therefor." A. S. Frazer and G. A. Smith. Dated March 6th.

4,931. "Means for generating and impressing semi-cycles of electromotive force on electric circuits for telegraphic and other purposes." W. L. Wise. (A. C. Crehore and G. O. Squier, United States.) Dated March 6th.

4,941. "Improvements in the governing of electric motors." J. Eck. Dated March 7th.

4,954. "Improvements in electric clocks." J. Butcher. Dated March 7th. (*Complete.*)

5,010. "Improvements in or relating to electrical incandescent lamps." E. F. Moy and P. H. Bastie. Dated March 7th.

5,030. "Improvements in control apparatus for electric hoists and elevators." O. Imray. (A. E. Maccoun, United States.) Dated March 7th. (*Complete.*)

5,041. "Improvements in dynamo-electric machines." W. B. Sayers and Mavor & Coulson, Limited. Dated March 7th.

5,042. "Improvements in dynamo-electric machines." W. B. Sayers and Mavor & Coulson, Limited. Dated March 7th.

5,096. "An electric opera, field, or marine glass." H. F. Purser. Dated March 8th.

5,099. "Storage plates for accumulators and process for the manufacture of the same." E. Goller. Dated March 8th.

5,100. "Improvements in and relating to methods for charging accumulators." V. B. D. Cooper and E. Ridley. Dated March 8th. (*Complete.*)

5,104. "Reinforcement of electrical waves and avoidance of loss by straying reflection, &c., by means of a condenser." F. Braun. Dated March 6th.

5,111. "A new or improved electrically-operated gas tap and apparatus for lighting at a distance." G. Schunemann and O. Rieder. Dated March 8th. (*Complete.*)

5,130. "Improvements in electrical time switches." J. G. Statter. Dated March 9th.

5,151. "An improved envelope for electrical conductors." F. B. Cox. Dated March 9th.

5,167. "An economic carbon for arc lamps." M. P. McInnerny. Dated March 9th.

5,190. "Improvements in telephone switchboards." J. M. Overshiner. Dated March 9th. (*Complete.*)

5,191. "Improvements in lighting electric lamps." C. Curwen. Dated March 9th.

5,197. "Improvements in electric power station switches." H. W. Bowden and W. J. Allbright. Dated March 9th.

5,199. "Improvements in electrolytic decomposing apparatus." T. J. Holland and A. P. Laurie. Dated March 9th.

5,200. "Improvements in the manufacture of porous diaphragms for electrolytic apparatus." T. J. Holland and A. P. Laurie. Dated March 9th.

5,211. "Improvements in electric incandescent lamps." A. H. Miller. Dated March 9th.

5,217. "Improved construction of commutators for dynamos and electro-motors." J. Burke. Dated March 9th. (*Complete.*)

5,229. "Improvements in apparatus for making and breaking high potential electric circuits." The British Thomson-Houston Company, Limited. (E. M. Hewlett, United States.) Dated March 9th. (*Complete.*)

5,250. "Automatic electric brake." C. W. Hill. Dated March 10th.

5,255. "Improvements in electrical switches." R. F. Hall. Dated March 10th. (*Complete.*)

5,262. "Improvements in electrical tumbler and other switches." R. F. Hall. Dated March 10th.

5,279. "Improvements in electric cables." J. A. L. Dearlove. Dated March 10th.

5,296. "A method of distinguishing electric and other switches in the dark." G. S. Fort and A. Fort. Dated March 10th.

5,322. "Improvements in or in connection with apparatus for the production of ozone by electricity." J. H. Lamprey. Dated March 10th.

5,341. "Improvements in tumbler switches for electrical purposes." A. Watson. Dated March 11th.

5,356. "Improvements appertaining to electric arc lamps." H. Bennett. Dated March 11th.

5,374. "Improvements in and relating to electro-therapeutic baths and the like." J. J. Stanger. Dated March 11th. (*Complete.*)

5,392. "Improvements in controlling switches for electric motors." H. A. Earle. Dated March 11th.

5,398. "Improvements connected with electric traction." E. Bede. Dated March 11th. (*Complete.*)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, *price, post free,* 9*d.* (*in stamps*).

1897.

3,526. "Improvements in apparatus for the electro-deposition of metals." J. E. Hartley. (F. W. Zongsem, United States.) Dated February 10th, 1897. The articles to be plated are placed in a rotating barrel, elliptical or triangular in cross-section, so that during a portion of the revolution the articles scarcely move, while at others they are more or less violently disturbed. To further insure the required relative motion of the articles, cams on the axle may ride over rollers beneath so as to raise and let fall the barrel at regular intervals, or the driving pulley may be elliptical in section. Anodes are arranged around the vat, being connected by conducting bars to the lead. Another anode forms a continuous external coating to a central frame within the drum, and is connected by a wire to a non-rotative collar to which the lead is connected. The articles rest upon wires distributed over the interior surface of the drum, which are connected by a wire to a non-rotative loose collar to which the lead is connected. The drum is built up of longitudinal strips, with spaces between, and is provided with a sliding or hinged door. The axle is not continuous through the barrel, but each portion is attached to the ends by two screws, two longer screws serving to attach the anode frame to the same ends. 5 claims.

4,878. "Improvements in electric railway systems." C. F. de Redon. Dated February 23rd, 1897. Relates to a conduit system with insulated contacts and a magnetic circuit closer. *Conductors, Switches, Collectors.*—Insulated roller contacts, one of which acts as a return, are placed in a conduit, and are rubbed by a collector consisting of rods, &c., with curved ends. The switching appliances are contained in closed non-magnetic boxes, and consist of bell cranks carrying a permanent or electro-magnet and two contact plates adapted to bridge the two sets of contacts respectively. The magnet placed opposite the thin wall of the box is attracted by the collector so as to close the contacts, and the breaking is retarded by a bellows and leak off valve or other adjustable retarding device. The rollers are connected to the first set of contacts, whilst the other contacts are connected to the main conductor and the return conductor. By means of the auxiliary conductors, and the other conductors indicated, the rollers in advance of the switchbox in which the switch is thrown are put in circuit before the collector comes on to them. 8 claims.

6,181. "Improvements in electric cables and in their manufacture." W. P. Granville. Dated March 9th, 1897. Relates to improvements in cables of the pattern described in specification No. 8,573, A.D. 1895, are formed with the insulation solid, but have the two segments brought together and twisted in a machine with suitable guide rollers so as to form the assembled cable with an outer covering. In the case of assembled air space cables a sheathing of metal ribbons may be employed, the contained air or gas also being at high pressure. 4 claims.

6,674. "An improved dry primary cell or battery." W. Shaw. Dated March 13th, 1897. A zinc casing with paper cover constitutes the outer cell. A carbon rod is packed about with plumbago and manganese dioxide, and the electrolyte, a solution of zinc and ammonium chloride and acetic acid, is absorbed in plaster of Paris, stucco, paper pulp, sawdust, &c. A cloth cover and layers of sawdust and pitch serve to seal the cell. 1 claim.